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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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AP1000 SUBCOMMITTEE

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THURSDAY

AUGUST 18, 2016

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 8:30 a.m., Harold B. Ray, Meeting Chairman, presiding.

COMMITTEE MEMBERS:

HAROLD B. RAY, Meeting Chairman

DENNIS C. BLEY, Member

RONALD G. BALLINGER, Member

CHARLES H. BROWN, JR. Member

MARGARET CHU, Member

MICHAEL L. CORRADINI, Member

WALTER L. KIRCHNER, Member

JOSE A. MARCH-LEUBA, Member

DANA A. POWERS, Member

JOY REMPE, Member

PETER RICCARDELLA, Member

GORDON R. SKILLMAN, Member

JOHN W. STETKAR, Member

DESIGNATED FEDERAL OFFICIAL:

PETER WEN

ALSO PRESENT:

LAWRENCE BURKHART, NRO

TZE-JER CHUANG, NRO

MANNY COMAR, NRO

JENNIFER DIXON-HERRITY, NRO

STEVE FRANZONE, FP&L

JOSEPH GIACINTO, NRO

ZACHARY GRAN, NRO

DAVID HEESZEL, NRO

PAUL JACOBS, FP&L

BERND LASKEWITZ, Westinghouse

WILLIAM MAHER, FP&L

JAMES MARRONE, Bechtel

MELANIE MAYES, NRO

BRUCE MUSICO, NRO

RICHARD ORTHEN, FP&L

FARHANG OSTADAN, Bechtel

PRAVIN PATEL, NRO

MALCOLM PATTERSON, NRO

KEVIN QUINLAN, NRO

RUTH REYES, NRO

MARY RICHMOND, Bechtel

PAUL RIZZO, Paul C. Rizzo Associates, Inc.

MUSTAFA SAMAD, Bechtel

ELLEN SMITH, NRO

LISA SCHLEICHER, NRO

ALICE STIEVE, NRO

RAO TAMARRA, NRO

STEWART TAYLOR, Bechtel

LEE TUNON-SANJUR, Westinghouse

ZUHAN XI, NRO

*Present via telephone

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P R O C E E D I N G S

8:31 a.m.

CHAIRMAN RAY: The meeting will now come to order. This is a meeting of the ACRS AP1000 Subcommittee. I'm Harold Ray, chairman of the subcommittee.

The meeting is scheduled for two days and will continue tomorrow for as long as necessary up to the full day. In that regard, we may remain in session for a limited period beyond the scheduled time today in order to reasonably ensure that we can finish within the scheduled time tomorrow, but we will not go later than the schedule today just in order that we can finish tomorrow for your personal planning purposes.

ACRS members in attendance are Ron Ballinger, Peter Riccardella, Dana Powers, Margaret Chu. I don't know if Walt is planning to be here today. He hasn't arrived yet. Jose March-Leuba, Michael Corradini, Dick Skillman, John Stetkar, Charlie Brown, Joy Rempe, and we expect Charlie to be joined by the ACRS chairman, Dennis Bley.

Peter Wen of the ACRS staff is the Designated Federal Official for this meeting.

The purpose of this meeting is to

review the Florida Power & Light Company's Turkey Point Units 6 and 7, combined license application. Florida Power & Light Company is referred to in its application as FPL and we will do the same here today.

We will hear presentations from FPL and the NRC staff. The entire meeting will be open to the public. The subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions as appropriate for deliberation by the full committee.

This license application is being processed in accordance with what is known as a design centered review approach. The referenced plant using this approach for AP1000 is the Vogtle Electric Generating Plant Units 3 and 4.

The Turkey Point Station Units 6 and 7 is known as a subsequent plant application. Consequently, this meeting of the subcommittee will limit its review scope to Turkey Point site-specific matters.

In this regard, I'll draw attention now to at least two site-specific matters which requires to implement regulatory requirements that the committee has not addressed in prior

application reviews. These requirements are in 10 CFR 100.21(h) concerning population density and 10 CFR 20.2002 concerning the requirements for an alternate method of radioactive waste disposal, liquid radioactive waste disposal.

Therefore, during the meeting, we may pursue process-related matters more than usual, both with the applicant and staff, even where the facts and the application are straightforward and not themselves in question. It is always important where precedents are being set that we are clear concerning all of the considerations which apply both during the course of this public meeting and in the letter which is ultimately approved by the full committee.

The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the Federal Register. The detailed procedures for the conduct of and participation in ACRS meetings were published in the Federal Register on November 8, 2013 as part of the notice of this meeting.

Peter, that date seems wrong, but I'll just note that and continue on.

The subcommittee intends to gather

information, analyze relevant issues and facts and formulate proposed positions and actions as appropriate for deliberation by the full committee.

We have received no written comments or requests for time to make oral statements from members of the public regarding today's meeting.

A transcript of the meeting is being kept and will be made available as stated in the Federal Register notice. Therefore, we request that participants in this meeting use the microphones located throughout the meeting room when addressing the subcommittee. Participants should first identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

We believe we have several people on the public phone bridge line listening to the discussion. We also have an overflow room, if needed, for audience members next door.

To preclude interruption of the meeting, the phone line is placed in the listen-in mode. We will open the line for any public comment at the end of today's meeting prior to our recess, and then again at the conclusion of the meeting tomorrow whenever that occurs.

Finally, I would ask that all mobile devices be put in a mode in which they will not interrupt the meeting if they should sound off.

With that, we will now proceed with the meeting and I will call upon Mr. Manny Comar of the NRO staff to begin.

Manny?

MR. COMAR: Good morning. I am Manny Comar, lead project manager for Turkey Point Units 6 and 7 license application. I want to thank the chairman and the members of the AP1000 Subcommittee to give us this opportunity to present the key issues of the staff review of the Turkey Point combined license application.

Jennifer Dixon-Herrity, Branch Chief of Licensing Branch, sitting on my right is also here to support this briefing. And that's all I have on the opening remarks. Thank you, Mr. Ray.

CHAIRMAN RAY: Thank you, Manny. I'm sorry I was distracted. Well, with that then we're ready to proceed are we? Indeed. All right, fine, thank you.

Please FPL representatives, please introduce yourselves and proceed. Thank you.

MR. MAHER: Good morning, Chairman Ray,

members of the committee. Thank you very much for having us here. My name is Bill Maher and I'm senior director of New Nuclear at Florida Power & Light.

On behalf of NextEra's over 14,000 employees, I'm honored to be here to present the Turkey Point COL application for your review. With operations in over 27 U.S. states and 4 Canadian provinces, comprising over 45 gigawatts of generation with approximately 25 percent of that from nuclear, NextEra is proud to be the number one generator of clean energy in the United States.

Today, we plan to present the Turkey Point COL application with a focus on the site-specific aspects of our application. I want to say at the onset that we appreciate the significant effort that has gone into this process by both the NRC staff and the ACRS.

In selecting a new site for new nuclear generation. FPL considered sites around Florida. A rigorous evaluation based on the EPRI site-selection guidelines resulted in the selection of the Turkey Point site near Homestead, Florida. This is a site that is currently used for two other nuclear powered units and several other generating

units powered primarily by natural gas.

Our focus today will be to discuss the site-specific aspects that we've identified and how these have been addressed. FPL submitted the Turkey Point COL application in June of 2009, so we're pleased to be here at what I call a milestone meeting.

Our application is based on the AP1000, Revision 19. We have closely monitored the development of the AP1000 detailed design through our active involvement in APOC and the Design Center consisting of Florida Power & Light, Duke, Southern, and SCANA.

Nuclear power remains an important element of FPL's reliable, low-cost power to our customers. Plant and service states in the time frame of 2028 and 2029 support our generation needs and the time line enables FPL to benefit from the experience of other AP1000 projects under construction. However, FPL has determined that the final decisions regarding Turkey Point construction will be made after issuance of the COL in order to capitalize on the completion of the projects currently under construction.

There are many reasons that the Turkey

Point project is important to FPL and this meeting is a significant milestone to us. Our team is ready to present the Turkey Point COLA information so that you will be able to find reasonable assurance that Turkey Point can be built and operated without undue risk to the health and safety of the public in an environmentally-responsible manner.

Again, we appreciate the significant effort that the NRC staff and the ACRS has put into reviewing the Turkey Point COLA. The staff's review has been extensive and thorough and accomplished with the highest degree of professionalism. We are ready to discuss the Turkey Point COLA and at this point I'll turn it over to Steve.

MR. FRANZONE: Good morning, Chairman Ray, and members of the Advisory Committee on Reactor Safeguards, the AP1000 Subcommittee. My name is Steve Franzone. I'm the Florida Power & Light Licensing Manager for New Nuclear Projects. In that role, I'm responsible for licensing of Turkey Point Units 6 and 7.

Slide 4 and 5 provide a listing of the topics we'll be discussing for the next two days.

Next slide. All right, go to the next slide.

Today, I would like to give the committee an overview of the Turkey Point 6 and 7 sites.

Slide 8, please.

This is a map of South Florida area. And it shows Turkey Point's location relative to Miami. The site is located in southeastern Miami-Dade County, approximately 25 miles south of Miami. On the east of the plant are Biscayne Bay and Biscayne National Park. To the west of the plant are the two closest cities which are Homestead and Florida City. Just past those cities you'll find Everglades National Park. The site is eight miles east of Florida City and nine miles south/southeast of Homestead, Florida. The Homestead Air Reserve Base is located north-northwest of the site.

The closest primary public roads are U.S. Highway 1 --

CHAIRMAN RAY: Let me just interrupt you at this point here because somewhere we got a distance to Homestead of 4.5 miles. What is that related to? Is that the nearest --

MR. FRANZONE: That's probably the

Homestead Speedway. That's about five miles, just under five miles from the site. The city proper is about nine miles.

CHAIRMAN RAY: All right. I didn't know whether it was to the center or to the edge or what it was we were talking about.

MR. FRANZONE: Yes, that's to the center, the nine miles. And it's -- well, I'll go on. The closest primary public roads are U.S. Highway 1 and the Homestead extension of Florida Turnpike. That site is typically accessed from Southwest 344th Street. It's also known as Palm Drive and it's just a straight shot into basically Homestead, Florida City. It's right at the end of that Palm Drive.

Next slide.

So here's a listing of some of the high points of the Turkey Point site history. But if we go to the next slide, I'll discuss each of these points as we go.

So we're on slide 10.

The Turkey Point site is approximately 9400 acres, tract. The site currently includes five FPL power plants, two natural gas/oil conventional boilers, two Westinghouse Pressurized

Water Reactors, and one combined cycle natural gas. And hence, the proposed Westinghouse AP1000 will be Units 6 and 7.

As you can see just north of the 6 and 7 site, we have the Turkey Point Units 4 and 3 which are the nuclear units. Next, we have the Units 2 and 1 which are the gas/oil units. And then Unit 5 is the combined cycle. So it goes 4, 3, 2, 1, 5 back to south again to 6 and 7.

From the previous slide, the site construction started on the two original oil units in 1965. Construction on the first nuclear unit started in 1967 when they granted the construction permits for 3 and 4.

They commenced operation in 1972 and 1973 respectively. Although not listed on the site, on the previous slide, the site did experience Hurricane Andrew in 1992.

In 2007, Turkey Point Unit 5 began commercial operation. The COL application that Bill stated was in 2009. Since we've submitted the application, the two existing nuclear units completed power uprates of about 100 megawatts each for a total of about 800 megawatts electric each unit.

And in addition, the original units are actually in the process of being retired and dismantled, so Unit 2 has actually been dismantled. May be complete by now.

Of course, you'll notice the industrial waste water facility. It's also known as the cooling canal, the largest thing on there. The cooling canals are about two miles wide, east to west, and five miles long north to south. The cooling canals consist of 168 miles of recirculating canals that occupy and area of approximately 5900 acres. The canals are 200 feet wide, generally shallow, 1 to 3 feet of water depth. The berms on the canal are about 90 feet wide.

Next slide, please. Slide 11.

On this slide, I'll point out a few specific items. Located about five miles west of the site, you'll see the Homestead Speedway. And just above the speedway, you'll find the Homestead Air Reserve Base. You can see it on this tract much better. You'll see the runway there.

The orange lines are the natural gas transmission lines for the site. The primary cooling source is reclaimed water received from

Miami-Dade County. The reclaimed water is first sent to an onsite water treatment facility which is shown as the light blue rectangle just northwest of Units 6 and 7. It's located just on the north side of the cooling canal discharge.

The FPL reclaimed water treatment facility is designed to remove and reduce the levels of constituents such as iron, magnesium, oil and grease, total suspended solid, nutrients and silicate in the reclaimed water. After processing, the water is sent to the makeup water reservoir located on the 6 and 7 site.

Please go to slide 12.

Unless anyone has any questions, we'll go right to the next slide, slide 13.

This is an overhead view of the existing site looking east towards Biscayne Bay. The site is an approximately 218 acre island area with industrial waste water facility cooling canal in the middle of the cooling canal. It is primarily a limestone site with alternating layers of silty sand and limestone. The finished grade of the nuclear island will be approximately 26 feet, 25.5 feet to be exact, due to storm surge wave run up.

In the upper left hand side, you'll see what is actually Turkey Point. It's that little jut out there, the land that juts out there. Out there is where we plan to have radiocollector wells which will be the backup source of cooling water for the Turkey Point 6 and 7. It's a rainy well system similar to that used in other facilities.

Slide 14.

The south side of the site is at the bottom of this slide. The primary cooling water source again is the reclaimed water and you can see the makeup water reservoir at the bottom there. The reservoir contains approximately a three-day supply of cooling water for the plant. Turkey Point Units 6 and 7 will be using mechanical draft cooling towers.

Just north of the reservoir of the two AP1000 units located side by side, Unit 6 is on the right. Unit 7 will be on the left. The little orange boxes you see with the dot in the middle are the underground injection control wells that are part of the deep well injection system which will be used for effluent and blowdown disposal. We will have 12 deep wells for injection with one monitoring well for each pair of deep wells. Of

course, we'll be discussing this topic in a lot more detail later today in the afternoon.

Just a little further north of the units you'll see the clear sky substation along with the parking facility.

Slide 15, please.

Several issues have caused our application to change. The Fukushima event occurred in March 2011 and caused the staff to take a hard look at many of our site characteristics. In addition, many of the recommendations were addressed by standard licensing conditions. We'll discuss those tomorrow afternoon as part of Chapter 20.

The CEU seismic source characterization sensitivity was completed and was found to be acceptable and the results will be discussed tomorrow morning as part of Section 2.5.

Another issue that came up was NRC Electrical Bulletin 2012-01 related to offsite power loss of phased events that occurred at the Byron Station. This revealed some weaknesses in current operating plant protection. The AP1000 is very robust in terms of design and protection from a similar event.

To summarize, AP1000 we have addressed by providing additional alarms for the control room and follow the standard AP1000 response. And then, of course, there's a five generic design issues required by Interim Staff Guidance 11.

MEMBER BLEY: Excuse me, are you going to talk more about that later, the open phase?

MR. FRANZONE: We had not planned on it. We can though.

MEMBER BLEY: Do you have automatic separation on open phase built into this system?

MR. FRANZONE: Yes and no. There's some of the inverters and stuff have trips that will trip the inverters prior to the loss of phase. But as part of the response, if I remember correctly, all we're really adding is alarms in the control room that sensing it out in the switchyard versus waiting until it gets to the -- the inverters are close to the actual components are that affected in the control room.

MEMBER BLEY: Okay. Thank you.

MR. FRANZONE: Okay, then the five generic design issues for Interim Staff Guidance, these were previously reviewed on the Levy docket and our submittals are technically identical. FPL

participated in the review of these issues as part of the Design Center Working Group review effort led by Duke Power and we will discuss those issues in more detail tomorrow afternoon.

As you can see, we had several Turkey Point site-specific challenges. These included the postulated karst-related deformations and the development of the Cuban seismic source catalogue. Both of these topics will be discussed as part of Section 5.2.5 tomorrow.

Additionally, we addressed missiles generated by hurricanes due to the issuance of Reg. Guide 1.221, design basis hurricane and hurricane missiles for nuclear power plants. Again, this is presented in more detail in the Chapter 3 presentation tomorrow.

And finally, the use of the deep well injection for disposal of effluent is the first of its kind in the United States for nuclear plants and will be discussed later today.

Slide 17, please.

On this side, you'll see our team of vendors who assisted us in completing and updating the application. Many are here in the room today. And that concludes my presentation, unless you have

any questions.

CHAIRMAN RAY: No, that's a fine overview, Steve. And it's again, I repeat what I said in my introduction, it's not characterized as a challenge, but we are going to want to walk rather methodically through the population exceedance issue just so we understand procedurally how that's addressed. Okay?

MR. FRANZONE: Okay. At this point then we'll turn it over to Paul Jacobs and Mary Richmond to discuss that very subject.

I'm sorry, we're not up yet. I'm sorry. I jumped the gun. We're not going to present it --

CHAIRMAN RAY: Not to worry.

MR. FRANZONE: I was so anxious to get the --

CHAIRMAN RAY: Well, it's the least of our concerns. So we welcome Manny and Lisa.

MR. COMAR: Did I get it? Okay. This is going to be a brief presentation. Good morning. I'm Manny Comar, the lead project manager for Turkey Point from the staff side.

This is going to be a brief presentation on the Chapter 1 and I think some of the information will be repeated with what Steve has already

presented, but the first day after the overview, we'll be presenting sections of Chapter 2 and after lunch, we'll switch back to 11.2 as the chairman indicated that we want to talk about the deep well injection during the first day.

Next slide.

The second day review we'll begin with a review of Chapter 2.5, after having left 2.4 back in the deep well injection. We'll start with 2.5 tomorrow and follow the review presentation in sequential order of the chapters.

Next slide, please.

Manny Comar and Lisa Schleicher on my left are the Chapter PMs for Chapter 2. She'll be coordinating that tomorrow and today. And Ruth Reyes is the Chapter PM for 3 and I think she was going to be here. She'll be here.

Jordan Hoellman has coordinated the incorporation of changes to the Chapter 21 ASE. This chapter presents the staff's evaluation of the ISG-11 issues. These are presented to the subcommittee in the Levy docket and will not be presented again.

CHAIRMAN RAY: Manny, say that last sentence again, please?

MR. COMAR: The Chapter 21 of the ASE incorporates the ISG-11 issue that was reviewed under the Levy docket. So we have provided the Chapter 21 --

CHAIRMAN RAY: That's fine. I didn't understand your last sentence. That's fine. Thank you.

MR. COMAR: Okay. And the next reviewers for today, talking about the population density is going to be Rao Tammara. He's going to talk about Section 2.1 and 2.2. Kevin Quinlan is going to talk about meteorology and we have Joseph Ciacinto talking about hydrology and Zachary Gran is talking about 11.2 this afternoon. So these are the four primary reviewers for this application.

MEMBER POWERS: In the hydrology discussion, this is a peculiar geographic, geologic site. It's unmetamorphized limestone with silt, so it's a disequilibrium geology and now we're talking about injecting things into this structure.

Will that be discussed in the course of the hydrology discussion?

MR. COMAR: That will be discussed tomorrow in 2.5. You're talking about the geology and the karst formation?

MEMBER POWERS: Yes, well, what I'm worried about is degrading the limestone in this thing.

MR. COMAR: Well, I think you will hear about that tomorrow.

MR. FRANZONE: Yes, this is Steve Franzone, Florida Power & Light. In the 2.4 discussion, we'll go into some of that specifically related to where the injection is going in, which is the boulder zone which is like 3,000 feet down. So yes, so some of that will be discussed today, especially the part related to the deep well injection.

MEMBER POWERS: We'll definitely want to talk about the deep well injection. I think we also need to discuss the shallow structures down to a 1,000 feet in a fair amount of detail.

MR. FRANZONE: Yes, sir. The shallower stuff will be discussed on 2.5.

MR. COMAR: That will be tomorrow.

MR. FRANZONE: Which is tomorrow morning.

MR. COMAR: Yes.

MEMBER POWERS: Okay. So I can go home now.

MR. COMAR: Next slide. As per our Design Center Review Board philosophy, no briefing is planned on Rev. 19 of the AP1000 certified design. That has already been presented. And there is no briefing is also planned on the standard content that has been incorporated by reference and has been reviewed previously by the subcommittee under the Vogtle docket. And the staff intends to brief all of the site-specific issues and -- I'm sorry, not all the site-specific issues, but the key site-specific issues that are related to this application.

Next slide.

And the COLA application consists of the Rev. 19 of the AP1000 design incorporated by reference; Revision 7 of the final safety analysis report that contains the standard content as well as the plant-specific content. The ISG-11 departures were submitted as mark up to the Turkey Point COLA and so these are being tracked as confirmatory items by the staff. We have not received the final update to the COLA for the ISG-11 issues.

Next slide.

The advance safety evaluation references the Vogtle FSER in the standard content evaluation

of the Vogtle FSER which is shown in the Turkey Point ASE as the double indented italicized information. It also contains language from the Bellefonte Units 3 and 4 which was reference COL and was replaced by Vogtle when Bellefonte decided no longer to continue their reference COL.

The standard content that was resolved in the Bellefonte docket was carried over to the Vogtle docket. And the Turkey Point plant specification was directly addressed in the ASE and that was submitted to the subcommittee last month.

And as I said, ISG-11 issues were evaluated in the Levy docket and has been incorporated by reference in Chapter 21 of the ASE.

Next slide, please.

The staff will now be presenting these chapters as they are incorporated by reference to the AP1000 design or contains standard content. The reason Chapter 6 and 9 are bolded as the topics, presented in these chapters of FSER are being addressed in other chapters of the ASE. For example, the deep well injection -- the FSER is identified in Chapter 9, but we are addressing it as part of Chapter 11.2, so that's the reason these two chapters are being identified as such.

Next slide, please.

The Turkey Point COLA is divided into 11 parts and the staff evaluations of where these topics are discussed in various chapters of the ASE. We don't need to go through them. These are the 11 parts. This is what they contain. And on the right-hand side where the staff has addressed those topics.

Next slide, please.

And the FSER Chapter 1 addresses the topics as shown here and I think that concludes my presentation.

CHAIRMAN RAY: Any questions for the staff at this point? We've been provided an overview of what we're going to be receiving and had a couple of comments so far. Are there any others? Thank you, Manny.

MR. COMAR: Thank you. Thank you, sir.

CHAIRMAN RAY: So now we'll look forward to our applicant.

MR. JACOBS: Good morning. I'm Paul Jacobs. I'm the engineering supervisor for NewNuclear project for Turkey Point 6 and 7. Presenting with me today is Mary Richmond. Mary is the supervisor of Engineering, Environmental

Engineering for Bechtel. We will be discussing Chapter 2, Sections 2.1, geography and demography; Section 2.2, nearby industrial transportation and military facilities; and Section 2.3, meteorology.

Slide 20, please.

DCD Rev. 19, Tier 2, Table 2-1 provides the site parameters for the AP1000. The Turkey Point FSAR Table 2.0-201 provides a comparison to the Turkey Point unit site parameters. All of the Turkey Point units 6 and 7 site specific parameters are bounded by the DCD site parameters with the following exceptions: air temperature, wind speed, and population distribution exclusion area.

Mary will begin by discussing Sections 2.1, 2.2, and 2.3.

CHAIRMAN RAY: I just have one question. The use of the term exclusion area, is that meant to be precise? I mean we're talking about the population distribution that's described in the guidance which is more than the exclusion area.

MS. RICHMOND: That's correct.

CHAIRMAN RAY: Okay, so I just wanted to make sure we weren't just focusing on the exclusion area itself as it is defined in the regulations. So thank you.

MS. RICHMOND: First, we're going to start out talking about Section 2.1 which is geography and demography, it's Slide 22, Steve.

FSAR 2.1 provides information related to site boundaries and locations of sites with respect to natural and man-made features. The information presented herein is in support of COL information item 2.1-1.

The Turkey Point site as described earlier is located in Miami-Dade County, Florida about 25 miles south of Miami. Some of the prominent natural features include the Biscayne Bay and Everglades National Park; closest municipalities, Homestead, Islandia, and Florida City.

Next Slide 23, please.

This figure provides a perspective and was shown earlier of the Turkey Point site location, located with the red dot in relation to some of the geographic features that were discussed earlier. And for reference, the red circle is a 50-mile circle.

Slide 24, please.

Okay, 10 CFR 21(h) says the reactor should be located away from very densely population

centers and that areas of low population density are generally preferred. With respect to the closest population center requirement, 10 CFR 100.21(b) requires that the population center distance be at least one and one third times the distance from the reactors to the low population zone.

The closest population center defined by 10 CFR 100.3 is Homestead with a population of 60,512. The population center in that definition is a population center greater than 25,000. The Turkey Point site meets this requirement of 10 CFR 100.21(b) as it is a distance of 1.6 times the radius of the seismal LPZ centered on Units 3 and 4.

Next slide 25, please.

I think this is the one most people are interested in. We've heard some questions about this. The population density surrounding the Turkey Point site was also evaluated. With respect to population density, Reg. Guide 4.7 provides the following guidance that a reactor should be located so that at the time of initial plant approval within about 5 years thereafter the population density averaged over any radial distance out to 20 miles should not exceed 500 persons per square mile.

The graph shown on this slide depicts

this evaluation. Although difficult to see in this figure, at the 1-mile radius the projected 2030 population for Turkey Point is greater than the 500 persons per square mile. As you go out from the 1-mile radius until some distance between the 5 and 10-mile radius where the projected population remains greater than the 500 person per square mile, the guidance suggested in Reg. Guide 4.7.

Next slide 26, please.

Because the guidance contained in Reg. Guide 4.7 related to population density was formulated as part of NRC's defense-in-depth philosophy to facilitate emergency planning and preparedness, as well as reduce potential doses and property damage in the event of a severe accident and given both Reg. Guide 4.7 and 10 CFR 21(h) provide that to determine the acceptability of a site located away from a very densely populated center, but in an area of low density -- not in an area of low density such as the Turkey Point site consideration should be given to safety, environmental, economic, or other factors.

FPL in two requests for additional information provided rationale and justification that the population density surrounding the Turkey

Point site did not pose an impediment to the development of the emergency plans and/or radiological safety. Specifically, the Turkey Point site characteristics meet the radiation dose requirements in 10 CFR 52.79.

Additionally, the emergency plan and the evacuation time estimate account for the surrounding population density at the Turkey Point site.

FPL also provided its consideration of other factors in the RAI responses in selecting the Turkey Point site. For instance, during the initial screening process for the alternative site analysis, specific consideration was given to the avoidance of high population areas. In fact, a prominent weight factor was given to the population in the screening analysis and there was only one other factor that was given a higher weighting and that was cooling water supplies.

From this analysis, Turkey Point was still one of five candidate sites that moved forward and ultimately there are no other sites that proved environmentally preferable to the Turkey Point site.

Additionally, during that analysis there were other factors that were identified that were specific to the Turkey Point site. These include

its unique ability to balance a generation load in southeast Florida, the unique cooling water supply system that you'll be hearing more about later which includes the reclaimed water from Miami-Dade County and the available backup water from the radiocollector wells. These two factors were critical objectives in the site-selection study.

Other factors included the land availability at an existing nuclear plant, the existing nuclear infrastructure, and the existing emergency plan and infrastructure present for the Turkey Point site.

Next slide 27, please.

CHAIRMAN RAY: Let's stop here for a second now.

MS. RICHMOND: Sure.

CHAIRMAN RAY: As I said in the beginning and repeated and I'll say again now, we're going to have to step a little slowly here.

MS. RICHMOND: Okay.

CHAIRMAN RAY: And there's one -- because this is the first time we've encountered this specific case. The guidance to which you refer has a provision in it that uses the phrase well in excess, not well in excess. In other words, in

order to do the things that you described having done looking at alternative sites, considering what the effect would be of siting at this location and so on, according to the guidance, as I read it anyway, you have to first decide you're not well in excess of the 500 persons per square mile which is the interpretation of the regulation itself that is provided in the guidance.

In looking at it, there are different ways of trying to figure out how much in excess one is. You've got a graph here that you've given us that we may want to go back and look at. But just to start with, how do you evaluate, how did you evaluate that phrase "not well in excess"? Apparently, your judgment is that you're not well in excess, otherwise these measures that you describe according to the guidance anyway wouldn't have been appropriate.

MS. RICHMOND: Okay, well, there's not a specific mathematical figure that provides that I'm aware of for the guidance.

CHAIRMAN RAY: Agreed. Agreed.

MS. RICHMOND: As you can see, if you look for the 0 to 5, I think the guidance, we looked at it as are we well within the density so that the

dose is not being impacted, that we can still provide safety.

And if you see from 0 to 5 miles which is the EAB is within that distance exclusion area boundary, and the doses are met, we are within the population density. In fact, I did mention that the first radii, the one-mile radius, we are slightly over and that has to do with just the transient population is also included in this analysis. So it's actually the Turkey Point workers when you project that population.

So within five miles of the site, the population density does remain below the 500 persons per square mile projected out.

VICE CHAIR CORRADINI: Can you just repeat because I couldn't tell, what is the EAB in the LPZ distances?

MS. RICHMOND: The exclusion area boundary, actually we're going to get to the EAB distances.

VICE CHAIR CORRADINI: Okay, so what's the LPZ distance then?

MS. RICHMOND: That's five miles center from Units 3 and 4 reactors.

VICE CHAIR CORRADINI: Okay, so 3 and 4

is the marker right there --

MS. RICHMOND: Correct. They're sharing that low population center.

MEMBER POWERS: When you speak of the ETE, is that just the 3 and 4 ETE or did you do one special --

MR. FRANZONE: The ETE we did do a common ETE.

CHAIRMAN RAY: Again, name, please.

MR. FRANZONE: I'm sorry, Steve Franzone, Florida Power & Light. We did do a common ETE with Units 3, 4, 6 and 7. Subsequent to that, they've done their own because there's some other requirements, but we did have a common ETE with 3 and 4.

MEMBER POWERS: And I simply don't remember the 3, 4 ETE submission. Can you remind me what its features were?

MR. FRANZONE: I'm sorry, say that question again?

MEMBER POWERS: What were the features? I don't remember the Turkey Point ETE submission and I just wanted what its features were especially for the two-hour and the eight-hour time zones, times.

MR. FRANZONE: I'd have to get back to

you on the details of that, but we can certainly pull those out.

MEMBER POWERS: I can probably look it up.

CHAIRMAN RAY: Well, again, I'm trying to focus here on how we apply the guidance or whether we decide the guidance doesn't apply and so I'm going to be very pedantic on this issue of the language in the guidance and how you interpreted it, relative to -- seems like there's a threshold that has to be met which is to say you're not well in excess if you're going to comply with the guidance. And do I understand you to say it's your judgment that you meet that criteria, that you're not well in excess?

MS. RICHMOND: Correct.

CHAIRMAN RAY: We'll discuss this with the staff.

MS. RICHMOND: Right.

CHAIRMAN RAY: And they did use the term -- I forget whether I can look it up, but higher density or high density area in their safety evaluation.

So we're just trying to make sure that we understand where we are relative to this guidance

because like you say, the steps that you went through to evaluate the emergency planning effects, the compliance for the dose limits and so on, has to follow, if you're using the guidance, the threshold which is we're not well in excess because it explicitly provides that that must be the case.

And frankly, as you said, we have no precedent to look to as to what is well in excess and we're going to have to address ourselves to that somehow. But once again, if you just say on the record your conclusion is that you're not well in excess, is that right?

MS. RICHMOND: That's correct.

CHAIRMAN RAY: Okay. Any other questions? John.

MEMBER STETKAR: Yes, I heard what you said. I was just curious, there is another tool that I was thinking about. That tool is a risk assessment. How did you use the Probabilistic Risk Assessment to help your conclusions about this?

For the record, the AP1000 Design Certification did a Level 3 Probabilistic Risk Assessment, but only for internal events, and it has been incorporated by reference for the Turkey Point application. So, you do have a risk assessment that

extends out at least for a subset of all initiating events that extends out to population dose at least at the site boundary, but you do have dose frequency estimates. So, how did you use those?

MS. RICHMOND: Well, we didn't specifically look at the PRA in itself, but that, the AP1000, if you look at the site parameters -- and that's kind of why I was focusing on the zero-to-5 mile there, which it is not until after 5 miles where we start to go over that 500 density.

MEMBER STETKAR: But I have a risk assessment, and I have wind rose and I have population density. So, you are telling me you just ignored that information?

(No response.)

MEMBER STETKAR: I'll take the silence as affirmative that that information was ignored. Thank you.

We'll revisit that with the staff because the staff also makes risk-informed decisions.

So, staff, please be prepared to tell us how you considered the risk information, because you have access to the Design Certification PRA results also.

MR. COMAR: This is Manny Comar.

We're going to have somebody available for those purposes.

MEMBER STETKAR: Good. Thank you.

MEMBER SKILLMAN: Mary --

MR. COMAR: Thank you.

CHAIRMAN RAY: So, you see, we're talking -- excuse me -- both very deterministic, which is where I'm coming from; John's looking at it from a different perspective. But we're trying, recognizing that we may need to apply the same process in the future, we're trying to understand how we get to the conclusion. Even if we happen to be prepared to agree with it, we need to know how did we get here.

I'm sorry.

MEMBER SKILLMAN: Yes. Thank you, Harold.

Mary, would you explain, the 500-per-square-mile using land area and the 500-square-mile using circular area?

MS. RICHMOND: Yes.

MEMBER SKILLMAN: I raise that question because off to the east you have got a --

MS. RICHMOND: Body of water.

MEMBER SKILLMAN: -- fairly large body of water that --

MS. RICHMOND: Correct.

MEMBER SKILLMAN: -- goes a long distance continuing to the east.

MS. RICHMOND: Right. And the guidance talks about the circular area. And you are exactly right, you know, we are not going to have people, unless they are in houseboats, living out of the body of water. And that is why both lines were presented there.

So, if you put all the population in the land area, you are going to have a much lower threshold than if you also include, just include in the circular area.

MEMBER SKILLMAN: Then, how come the cumulative population off to the east, which is water, is so much higher? It is almost twice at 20 miles.

MS. RICHMOND: No.

VICE CHAIR CORRADINI: Yes, I think all they did is take a circle and multiple by 500.

MS. RICHMOND: Right.

VICE CHAIR CORRADINI: So, it is counterintuitive to how it is labeled, but I think I

get it.

MS. RICHMOND: Uh-hum.

MEMBER SKILLMAN: Okay.

VICE CHAIR CORRADINI: And then, let me just, since we are looking at numbers and we are a bunch of engineers, as I pass through 5 miles, I start hitting these population centers of Homestead, and I can't remember the names of all the towns.

MS. RICHMOND: Islandia and Florida City.

VICE CHAIR CORRADINI: That is what pops them up.

MS. RICHMOND: That's right.

VICE CHAIR CORRADINI: Okay.

MS. RICHMOND: That's right.

MEMBER SKILLMAN: Good discussion. Thank you.

MS. RICHMOND: Sure.

MEMBER SKILLMAN: Thank you, Harold.

MEMBER CHU: Can I ask a question?

MS. RICHMOND: Yes.

MEMBER CHU: You know, this is a population forecast. Do you have any idea what is a usual uncertainty band in these forecasts? Is it 5 percent, 10 percent, 20 percent? Because we are

talking about 30 percent exceeding, I am just curious to see what --

MS. RICHMOND: Well, originally, we did from the 2000 and applied a growth factor. Then, we also looked at the 2010 Census Bureau and applied an additional growth factor. So, there's some growth factors that were involved in projecting those populations. They've increased the growth factors since from -- going from 2000 to 2010, the population significantly increased in the outer bands. I don't know if there is a margin that they apply to that. I would have to get back to you on that.

MEMBER CHU: Okay. Thank you.

CHAIRMAN RAY: Other questions? I want to make sure we get anything that a member has.

MEMBER BROWN: Just a question of information. For the uninitiated like me, in the past we have not, you said we had not addressed having to deal with exceedance of this type in previous certifications. Do we have any other plants that exceed population standards similar to this one? Is that --

CHAIRMAN RAY: Don't say no other plants. No other plants that we have --

MEMBER BROWN: Addressed?

CHAIRMAN RAY: -- processed, addressed ourselves to.

MEMBER BROWN: Okay. In recent time?

CHAIRMAN RAY: In recent times.

MEMBER BROWN: Okay. All right. I was just trying to get a calibration here.

CHAIRMAN RAY: And specifically, Charlie, I'm trying to, you know, in a very pedantic way, work through the regulation and the guidance. And let me just say right now, if this has been done before, please give me the citation. I would love to have it.

(Laughter.)

MEMBER BROWN: Absolutely.

CHAIRMAN RAY: Because I haven't been able to find it.

MEMBER BROWN: Okay. Well, that is why I asked.

CHAIRMAN RAY: Yes. Certainly, there are sites, one of which I used to operate, that exceed this criterion. I know that. That's not the point. The point is we are now implementing this here in this current process, and I need to make sure everybody is satisfied that we know how to do

it this time and next time.

VICE CHAIR CORRADINI: So, let me ask a question a little differently. So, I think I understand the blue and the dark blue, or the light blue and the dark blue.

MS. RICHMOND: Exactly.

VICE CHAIR CORRADINI: And I think I read the words -- Harold's just made me read them again -- for 10 CFR 100.21(h). So, I understand how you get the Y-axis. I don't understand where you stop worrying about the X-axis. And how do you interpret that?

In other words, I could pick any site in the United States, and if I go far enough out, it exceeds it. So, where do I stop on the X-axis in a reasonable manner? And your interpretation, because I'm going to ask the staff exactly the same question.

MS. RICHMOND: Out to 20 miles is what is required for us to report. Now, in looking at the impacts or risk, as Mr. Stetkar asked, if you are looking at the doses and the impact of having a higher density area, it is really within the zero-to-5-mile band, because that is where our doses are met, given the DCD site parameter values at both LPZ

and EAB, the site characteristics. As we will go into later, all these are met.

MEMBER POWERS: We usually consider out to 50 miles for interdiction of food stuffs, things like that.

MEMBER SKILLMAN: It is like emergency planning.

MEMBER POWERS: Yes.

MEMBER STETKAR: Well, and if you look at things like the SOARCA studies, they took it out to 50 miles for blatant cancer fatalities and, you know, evacuations, stuff like that.

VICE CHAIR CORRADINI: Right. But the reason I'm asking the question --

MEMBER STETKAR: It was 50 miles. It wasn't 20. It wasn't 5.

VICE CHAIR CORRADINI: But the reason I'm asking is that, from a siting standpoint, I'm reading the siting criteria versus because I was guessing you guys would answer 50 for emergency planning.

Okay. Thank you.

CHAIRMAN RAY: If nothing else, we will ask you to move on, please.

MS. RICHMOND: Okay. Slide 27, please.

Okay.

FSAR 2.1 also defines the EAB for the site. The EAB exclusionary boundary for Units 6 and 7 primarily lies within the EAB for Units 3 and 4, with the exception of the eastern and southern areas.

As you can see on the figure, the EAB in the southeast and south southeast sectors extends beyond the property boundary. However, this small parcel of submerged land is not reasonably accessed but through the FPL property.

The combined EAB provides the minimum distance of 1427 feet from the Unit 6 and 7 source boundary, with all sectors less than the half-mile population exclusionary site parameter value in the AP1 BCD, except for the south southwest and south southeast which meets the half-mile exclusionary limit.

Departure 2.0-4 addresses this departure from the half-mile exclusionary site parameter value. However, the determined Pi-over-Q values in all sectors are below 5.1 E to the minus 4 seconds per meter cubed DCD site parameter value. Therefore, this departure does not impact the design of the plant and the dose limits are met.

Next slide 28, please.

We are now going to discuss Section 2.2, nearby industrial transportation and military facilities. SAR 2.2 identifies potential hazards in the site vicinity that may impact the safe design and siting of the Turkey Point Plant. As such, in response to COL information Item 2.2-1, SAR 2.2 provides information about nearby industrial and military facilities, along with transportation routes, that may have an impact on the safe function of a plant.

The nearby industrial and military facilities identified include Turkey Point Units 1 through 5 and the Homestead Air Reserve Base.

The transportation routes identified include the onsite transportation routes, and these would be the onsite routes where chemicals would be coming, transported to the storage area or gasoline deliveries to the gas trucks, et cetera; the Miami to Key West, Florida Intracoastal Waterway and the Florida Gas Transmission Company's Turkey Point Lateral Pipeline, and Homestead Lateral Pipeline.

Airport and airway routes were also identified, and these include the Homestead Air Reserve Base, along with Airway V-3.

Next slide 30, please.

MEMBER SKILLMAN: Mary, before you proceed, in your Chapter 2, on page 31, in description of waterways, you identify that the only cargo on the Intracoastal Waterway is residual fuel oil. What is the likelihood that that cargo could be propane, gasoline in tankers or in bulk barge, other flammable, combustible, or explosive cargoes?

MS. RICHMOND: We looked at several years along the Intracoastal. We used the Army Corps of Engineers, and we looked at several years on the Intracoastal Waterways. And that was the only cargo that has been identified going up the -- in fact, that cargo, the original fuel oil is actually delivered to the Turkey Point Plant site.

We haven't seen any other cargo go up and down the river. We did look at propane storage that was closer-in, the actual storage. We also looked at natural gas, gasoline trucks. That was also evaluated, but not for the Intracoastal Waterway, but for other transport routes.

MEMBER SKILLMAN: Is there any control over what cargoes will be proximate, being towed or pushed --

MS. RICHMOND: No.

MEMBER SKILLMAN: -- on that waterway?

MS. RICHMOND: Not that I'm aware of.

MEMBER SKILLMAN: What action is available for you to know if a cargo that is different than what you have assumed is being hauled up that waterway?

MS. RICHMOND: Part of doing the 2.2 evaluation, you would have to -- and that is for any site -- you would continually have to update anything that is transported or any new facilities that may come into play. None were identified that would indicate that there would be a transport of anything other than what is there. But you would continually monitor the Army Corps of Engineer reports as they would do updates to their FSAR.

MEMBER SKILLMAN: If I may --

MEMBER BALLINGER: I think what Mr. Skillman is talking about is that let's say that you are just operating the plant and somebody decides, for one reason or another, to bring an LNG tanker down that waterway, or something like that, down that waterway. How would you know? And then, what would you do if that were to occur? Because I'm from the Boston area and I know what happens when an LNG tanker comes into Boston Harbor; there are a lot

of precautions that get taken with respect to other ships and things like that when that tanker comes in.

MS. RICHMOND: Okay. I will let Bill Maher --

MR. MAHER: This is Bill Maher, Florida Power.

To provide a little bit more detail to what Mary is talking about, that residual oil, that shipment that she is talking about was residual oil to fuel Units 1 and 2. Units 1 and 2 are in the process of being decommissioned. And some of the distillate tanks that are on property further north are going to be dismantled also. So, with respect to, if you want to call it, the frequency of what we have seen in the past, that should not happen anymore.

The actual delivery path, if you will, to the Turkey Point site is through the National Park. And Steve has a slide up there now. I don't know if you can see the bridge channel. But that is directly to the Turkey Point site through the National Park.

MR. FRANZONE: So, this is Steve Franzone, Florida Power & Light.

As Bill was saying, the path, if you see on the righthand side of the screen, the waterway is that waterway that cuts through the Biscayne National Park. There is a cutoff that actually goes to Turkey Points 3 and 4, the barge area right there, and it was normally used for fuel oil for the 1 and 2 Units, and it is a backup source for Unit 5, right.

But, going through the National Park, you know, there is nothing south of there. There is no industrial south of there that typically you would warn anything. And really, what it had been used for in the past was mostly Turkey Point Stream for the fuel oil. That is why we found no records of any other real activity, because south of there, there is just nothing there. There is no industry down south of there.

MEMBER BALLINGER: I think I now correct myself. That Biscayne Bay is only 6-feet deep.

MEMBER KIRCHNER: That's right, the draft is 6 --

MEMBER BALLINGER: So, they are not going to be getting anything, any big ships down through there.

MR. FRANZONE: Right. Okay. That's

correct, yes.

MEMBER BALLINGER: Yes, okay, got it.

MEMBER BROWN: Are there any State regulations or rules regarding what content can be transported along that waterway? I mean, you all considered what you all use, but it didn't sound like you addressed whether the State has other prohibitions on anybody else doing anything. It would kind of aid you in not knowing what is going on if you knew what the State allowed or the city, whatever is appropriate.

MR. FRANZONE: I know we have lots of regulations when we have to bring a barge in there. A lot of it is driven by the State requirements, but I can't cite you what State requirement it is.

MEMBER BROWN: Okay. All right.

MR. FRANZONE: We could certainly follow up.

MEMBER BROWN: No, it was just a way of kind of bounding what you have to worry about not considering. That is all I was thinking.

MEMBER SKILLMAN: The draft --

MEMBER BROWN: The draft, obviously --

MEMBER SKILLMAN: The draft to me is almost irrelevant in this discussion. Some of these

larger tows are only drawing 3 to 4 feet of water.

My experience on the Allegheny River, on the Ohio River, on the Rhine River is that propane barges can and are transported, and a gas cloud explosion or a deflagration has been considered in some of those sites, at some of those sites that are on those rivers.

I think the real issue here is it appears as though that channel that is 4 to 5 miles off to the east. And so, that is certainly a mitigating factor in whatever cargo might be on that waterway. But I would think the application would be more complete if it communicated, almost no matter what is being towed on that waterway, the distance is so great, that it is of no consequence to the proposed site.

And I will admit being aware of the potential for a tow to be shallow-draft LNG or propane. And you get the right wind conditions and the right combustion conditions, you can have one significant explosion.

MR. MAHER: This is Bill Maher --

MEMBER SKILLMAN: Thank you.

MR. MAHER: -- Florida Power, again.

Maybe just to go over what Mary had

said, too, we actually looked at the historical travel through the waterway. And the only travel of hazardous materials that we found through the waterway was for us. It wasn't actually an evaluation for us. It was that historical look.

MS. RICHMOND: Correct.

CHAIRMAN RAY: Just to be clear, you do address here on slide 31, I believe, the natural gas pipeline and conclude that it would not affect safe operation.

MS. RICHMOND: Right.

CHAIRMAN RAY: And so, that is important, in my mind anyway.

I understood the point about the fossil plants being decommissioned, but I don't think you want to put a prohibition on developing some replacement at a future time. So, our assumption would be, unless you want to correct it, that the natural gas pipeline would be there and available, and you have evaluated it as indicated here.

MS. RICHMOND: That's right.

CHAIRMAN RAY: Okay.

MS. RICHMOND: All right. Next slide 30, please, the figure.

And we have already spent a little bit

of time on this figure. But this figure illustrates some of the industrial/military facilities that were identified along with some of the transport routes. And for reference, a 5-mile radius is shown on the figure.

Next slide 31, please. Okay.

The hazards related to the storage and transport of the chemicals related to each of the industrial sites or along identified transport routes were evaluated to identify any design base events. And design base accidents internal and external to the nuclear plant are defined as those accidents that have a probability of occurrence on the order of magnitude of approximately 10 to the minus 7 per year or greater and potential consequences serious enough to affect the safety of the plant to the extent that the guidelines of 10 CFR Part 100 could be exceeded.

The determination of design base accidents included the consideration of several accident categories outlined in Reg Guide 1.206. Deterministic evaluations were first performed for those accident categories and include: explosions was the first accident category that I will be talking about. In this accident category we looked

at a complete failure of a tank and immediate detonation. And we also looked at the levies because of the propane storage, and we wanted to make sure that we got that in there, too.

VICE CHAIR CORRADINI: So --

MS. RICHMOND: Go ahead.

VICE CHAIR CORRADINI: -- I think this connects to Dick's question. So, what was the point source assumption for the levy?

MS. RICHMOND: For the levy, that was related to propane storage at the Homestead Air Reserve Base.

VICE CHAIR CORRADINI: So, 5 miles away?

MS. RICHMOND: Right.

VICE CHAIR CORRADINI: Okay.

MS. RICHMOND: There was no problem.

VICE CHAIR CORRADINI: Well, I was just trying to understand to connect it to his question, because I figured you had to assume some sort of chemical explosions, but I didn't know the distance.

MS. RICHMOND: Right. And so, there were several -- Units 1 through 5 chemicals probably would be close, closer. There was some chemical storage and explosions from chemicals stored, say, specific chemicals that were evaluated for 6 and 7.

There was also the AP1000 DCD chemicals. Those were evaluated already by Westinghouse. We only had to determine whether that safe distance was met for those.

So, this evaluation, most of the chemicals, minus the site-specific ones, are stored a little bit further away. So, the explosions, all of those, the analyses demonstrated there was peak positive of 1 psi or less at the safety-related structures.

Another accident category we looked at was the flammable explosive vapor cloud where there was a delayed ignition; there wasn't that immediate detonation. So, we looked at complete failure of the tank for liquids, formation of the cloud, and then, it starts to go directly towards the safety-related structure. And through modeling, we, then, either, you know, ignited by flame or detonated the cloud. In each case, it would not affect safe operation of Turkey Point Units 6 and 7.

We also looked at a jet fire from the pipeline and looked at some heat fluxes. Those were all well within the 5-kilowat-per-meter square limit there.

And so, then, we also looked at toxic

chemicals and their impacts or likelihood on the control room. And for each of the toxic chemicals that were evaluated, they were all well below the IDLH prior to reaching the control room air intake location, with the exception of chlorine and sodium hypochlorite storage. However, the concentration of both of those chemicals were below the IDLH inside the control room. So, in every case, all the analyses demonstrate that there would be no impact to the safe operation of Turkey Point 6 and 7.

Next slide 32, please.

And I have touched on this already. We also looked and made sure that all the chemical stored at 6 and 7, the AP1000 standard chemicals, were stored within the appropriate distance that meet those safe distance requirement. In each case, they met the safe distance requirements.

A review of aircraft and airway hazards was also performed, and the evaluation performed using the guidance and methodology specified in 3516 and in DOE standard 3014 was used. The total impact frequency was 2.56 E to the minus 7 per year -- 3.86, I'm sorry, minus 6 per year. This was dominated by the general aviation operations because there is much more likelihood for that to crash.

Because it was greater than 1 to the minus 7 per year, the frequency, an evaluation against the second criteria was presented in FSAR Section 1958.

MEMBER STETKAR: Mary, I looked for it; I couldn't find it. So, could you point me to the source of information that you used for the aircraft crash frequencies, or if you want to call them crash rates, for both airport operations, near airport operations, and continuous flight operations for both small military, large military, and general aviations?

MS. RICHMOND: The crash --

MEMBER STETKAR: Yes, the --

MS. RICHMOND: The crash frequencies?

MEMBER STETKAR: Yes. Not the 3.61 E to the minus 6 after you have accounted for impact areas and all of that stuff. I want to know how often these things fall out of the sky and where you gathered that information from, because that is not published in your report.

MS. RICHMOND: They are in the DOE standard 3014. We can get that --

MEMBER STETKAR: That's where you took them from?

MS. RICHMOND: Yes.

MEMBER STETKAR: Okay.

MS. RICHMOND: We can get those for you, if you would like to see them. They are tables.

MEMBER STETKAR: FAA has higher rates than that, by the way. So, I was just curious. That is where you plucked them from?

MS. RICHMOND: Right.

MEMBER STETKAR: Okay. Thank you.

MS. RICHMOND: Okay. Okay. Slide 33, please. Okay.

We are now going to be talking about SAR Section 2.3, meteorology.

Slide 34, please.

SAR 2.3 provides details about the climatological conditions and regional meteorological phenomena that could affect the safe design and siting of the plant in response to COL information Item 2.3-1.

The Turkey Point site is a relatively-flat site located on the lower east coast of Florida within the Atlantic Coastal Ridge. The general climate is classified as subtropical maritime, and the region is subject to sea, land, breeze circulations.

Slide 35, please.

The AP1000 DCD identifies several design parameters related to regional climatology. These design parameters include air temperature and wind speed/tornado design parameters related to regional climatology.

The next slide 36, please.

As indicated on the table on the previous slide, the determined site-specific characteristics are bounded by the AP1000 design parameters except for the maximum safety and normal wet bulb non-coincident air temperatures and the basic wind speed. The maximum safety wet bulb non-coincident temperature is approximately 87.4 degrees, which exceeds the AP1000 DCD Tier 1 and Tier 2 design value of 86.1 degrees Fahrenheit.

The Westinghouse evaluation included in Departure 2.0-3 concluded that the site characteristic value does not affect any systems, structures, or component, design function, or analysis methods presented in the DCD.

Similarly, the maximum normal wet bulb non-coincident temperature for Turkey Point site is approximately 81.5 degrees Fahrenheit, and this exceeds the AP1000 DCD Tier 2 design value of 80.1 degrees Fahrenheit.

The Westinghouse evaluation also included in 2.0-2 concluded that the site characteristic value does not affect any system, structure, component, or analysis methods in the DCD.

Slide 37, please.

The basic wind speed is approximately 150 miles per hour for the Turkey Point site. This was estimated from a plot of basically wind speeds in figure 6-1(b) of ASE 7-05. This exceeds the AP1000 DCD Tier 2 design value of 140 miles per hour 3-second gust. Westinghouse evaluation included in Departure 2.0-1 concluded that the increase in wind design speed will not affect the AP1000 design.

There are a few other wind characteristics related to the SRP guidance that I will briefly review. They include the 3-second gust speed for 100-year return value, which is 161 miles per hour. And this was just derived from using a scaling factor from the 50-year.

Also included in the SR is our nominal 3-second gust that can be expected to occur with a return period of 1E for seven years, and this was 260 miles per hour, and taking figure 1 of Regulatory Guide 1.221.

The next slide 38, please.

SAR 2.3 also provides information on local meteorology which influences the dispersion of any releases from the plant or in the vicinity of the plant. Data collected indicate that the annual wind direction generally follows an easterly orientation. It is only during winter that the relative frequency of north northwest winds is greater. On an annual basis, the mean wind speed at the 10- and 60-meter levels are 3.8 and 5.6 meters per second, respectively. There was only a few calm periods noted in the data.

This data indicates also that there is a predominance of neutral stability, Class D, and slightly stable Class E conditions throughout the year. The extremely stable conditions, Class G, most frequent during the winter and less frequent during the summer, only about 1.7 percent.

Slide 39, please.

MEMBER STETKAR: Mary, before you go on --

MS. RICHMOND: Uh-hum.

MEMBER STETKAR: -- to the detail that you have presented on slide 37, is there information from Hurricane Andrew that challenges any of the

information that you have presented here?

MS. RICHMOND: No. Hurricane Andrew was looked at in detail in the SAR. And I can't recall the exact wind speed numbers from Hurricane Andrew, but I think we have got that. I can get those for you, if you would like.

MEMBER STETKAR: No. That was just curiosity question.

MS. RICHMOND: Oh.

MEMBER STETKAR: I know that was a very serious event.

MEMBER RICCARDELLA: But they didn't exceed these maximum values.

MS. RICHMOND: Correct.

MEMBER STETKAR: Thank you.

MS. RICHMOND: Slide 39.

SAR 2.3 also includes information about the onsite Meteorological Measurements Program in response to COL information Item 2.3-3. The Turkey Point Meteorological Monitoring Program is comprised of a set of towers and associated systems, and it consists of two phases.

The pre-operational monitoring phase included data gathered from the existing Units 3 and 4 Meteorological Stations. The baseline data was

comprised of using the years 2002, 2005, and 2006. This period of data was the best-available data. It was representative and complete, meaning that analyzed data recovery was 90 percent without it being greater than 10 years old at the time. And this met the requirements of Reg Guide 1.23. The operational monitoring, the same operational set of the existing Meteorological Stations will be used for 6 and 7.

The next slide 40, please.

The collective meteorological data was used to determine the diffusion estimates for Turkey Point 6 and 7. These include short-term diffusion estimates, providing a response to COL information Item 2.3-4.

The NRC-sponsored PAVAN computer code was used to estimate the relative ground-level atmospheric concentrations or Qi-over-Qs at the EAB and LPZ for the potential accident releases of radioactive material. Included in our evaluation was a default value for airflow recirculation from Biscayne Bay which can increase the concentrations if you have recirculation. So, that was accounted for in the modeling. The results demonstrated that the Qi-over-Q values determined by PAVAN modeling

analyses at the EAD and LPZ do not exceed the correspondent AP1000 DCD Tier 1 and Tier site parameter design value.

Additionally, the NRC-sponsored ARCON96 model was used to estimate the control room Qi-over-Qs for potential accident releases of radioactive materials. These Qi-over-Q values were estimated at the control room HVAC intakes and the Annex Building access door receptors from eight release sources. These results also demonstrate that the Qi-over-Q values determined by ARCON at the control room air intake and the Annex Building access doors are bounded by the correspondent AP1000 DCD Tier 1 and Tier 2 site parameter design values.

The next slide 41, please.

SAR 2.3 also presents long-term routine diffusion estimates for continuous releases of gaseous effluents to the atmosphere. The Qi-over-Q and D-over-Q values were calculated at receptors of interest; for example, the EAB, the nearest resident, the nearest vegetable garden, nearest milk animal, and nearest meat animal. Again, to account for the possible land recirculation effects from the Biscayne Bay, some local default correction factors were implemented. In this case, the calculated

doses at the receptors or influence of interest were well below the 10 CFR Appendix I design objectives.

That's it. Questions?

CHAIRMAN RAY: Okay. Any further questions on these topics so far four our applicant?

(No response.)

CHAIRMAN RAY: We are doing very well with our schedule. Thank you.

MS. RICHMOND: All right.

CHAIRMAN RAY: And we will recess now until 10:15.

(Whereupon, the above-entitled matter went off the record at 9:55 a.m. and resumed at 10:15 a.m.)

CHAIRMAN RAY: We'll resume the meeting at this time.

First, a couple of housekeeping items I want to take care of. One is I noted in my introduction that the date that I stated for the notice of this meeting appeared incorrect, and, of course, it was.

The procedures, which I was combining with the other thought, for the conduct and participation in ACRS meetings were published in The Federal Register on November 8th, 2013. The notice

for this meeting was published in The Federal Register on August 1st, 2016, to complete the record and correct my earlier error.

Also, applicant has a few short items having to do with the immediately-prior discussion that they would like to put on the record by way of clarification.

So, Steve?

MR. FRANZONE: Thank you. This is Steve Franzone, Florida Power & Light.

Just three quick items. One is just to clarify Unit 5 is not going to be retired in the foreseeable future. There will always be a natural gas, we anticipate, at that site, just because of the power needs of Miami-Dade.

The second thing is in our FSAR, just to clarify, the one-minute sustained average based on a re-analysis of the Hurricane Andrew data is 145 knots, which equates to 167 miles per hour. And that, actually, was about 9 miles north of the site. So, I just wanted to clarify that. That is in our FSAR.

And the third item is just to clarify, the waterway we are talking about that we showed on the figure is typically used for recreational

vehicles or boats. The actual shipping channel is actually east of the Keys located. So, it is even further away from the plant. And the draft is around 6 feet there that is maintained. So, there is no destination per se at the end of that cutout for the waterway.

That's it. Thank you.

CHAIRMAN RAY: Thank you, Steve.

With that, we will continue with our agenda and welcome Mr. Burkhart. Or who is coming up to talk about this?

MR. BURKHART: This is Larry Burkhart, the Chief of the Radiation Protection and Accident Consequence Branch. We look at the population distribution and nearby industrial hazards.

Lisa, are you going to provide -- or Rao Tammara is our lead reviewer who will discuss how the staff completed its review on these issues.

MS. SCHLEICHER: Good morning. I'm Lisa Schleicher. I'm the Project Manager for the AP1000 Licensing Group, here for Chapter 2 on site characteristics.

And so, just to give you a brief overview, for Chapter 2 there are five subsections. So, first, we will cover the first four sections,

starting with 2.1 and 2.2 on your industrial/transportation facilities and, then, the geography/demography. And then, we will have 2.3 on the meteorology. And then, later this afternoon we will talk about 2.4 and hydrologic engineering. And then, tomorrow we will discuss 2.5 on the geosciences topics.

So, first, we have Rao Tammara, who will talk about 2.1 and 2.2.

MR. TAMMARA: My name is Rao Tammara. I am the Technical Reviewer for FSAR Chapters 2.1 and 2.2 for Turkey Point 6 and 7 COL application.

I am a chemical engineer. I have three master's degrees, one from India in chemical engineering. I have two from the University of Maryland, one in chemical and nuclear and the other one in environmental engineering.

I started my career in 1974 with the NUS Corporation, and I worked there for 32 years. I was involved in the earlier power plant ER help and, also, the FSAR operations later during the seventies and eighties. And later on, I switched to evaluation of DOE and sites for it and writing the Environmental Impact Statements. I was also involved in radioisotope reactors for the space

systems, generating the risk assessments. And later on, I joined the NRC in 2006. Since then, I have been working on all of the COL applications, ESP applications, and the DC applications. This is my background.

Presently, I am presenting the sections for 2.1 and 2.2. 2.1 covers the site location, exclusion area authority and control, and the population distribution. General site location deals with the general description of the area and nearby features, and exclusion area deals with the area that is -- they have how the ownership and the control in the case of the emergency. And the third part is the population distribution.

The applicant has provided all the information, and the staff has confirmed that information by going through the public domain, if the information is reasonable or not.

In particular of interest is the population density calculations because for this site the guidance of 500 people per square mile has been exceeded. Therefore, staff also has calculated independently to see whether that projection is valid, reasonable, or realistic.

So, applicant has originally provided

the calculation based upon the 2010 Census. And later on, they upgraded taking -- the 2000 Census, and then, they upgraded to 2010 Census. And staff has acquired some independent county projections. They have projected the population from 2006 to 2030. So, taking into account that information, staff has also calculated the density, and it is in excess of the criteria.

But, in order to satisfy the requirement of 10 CFR Part 21(h), the rationale we have to use and the rationale the applicant has to evaluate -- the first, in the FSAR, they said they pointed out that we have evaluated the alternative sites in the areas, an ER. And therefore, we have concluded, based upon that analysis, we have given enough justification.

But the staff was not satisfied with that one. Then, therefore, an RAI was issued to come up with a rationale, justification, and, also, summary of the analysis to show the factors economically, whether the site they have proposed or selected outweighs the other environmental and other aspects compared to the alternative sites they have evaluated.

So, based upon that one, they came up

with a justification and a rationale to justify. Therefore, based upon that one, and also the calculation we have made, from the applicant's analysis, the difference in calculation, what was the excess above 500, we came up with 600-and -- 165 people per square mile was higher when you apply the applicant's graph and characterization and, also, the information they presented in figure 2.12-17.

But, by looking at the county projections based upon 2006 to 2010, we calculated 676, about 176 people over the 500. So, the rationale we applied is it is excess, but it is not horribly excess. That is one point.

And the second point is --

CHAIRMAN RAY: Let me stop you on that one point because it is important.

MR. TAMMARA: Okay.

CHAIRMAN RAY: The advocate indicated that they had concluded that they were not -- now I am referring to the language in the guidance3 -- they were "not well in excess". Is that what you are saying also? The staff feels they are not well in excess?

MR. TAMMARA: Yes, that's correct, because 500, there is 176 compared to 500. Whether

it is well excess or not, at least in our mind it is not well excess.

CHAIRMAN RAY: Okay. That's what I wanted to be clear about.

And I think I should also say that staff, applicant, and, in fact, our own staff here with the Committees conclude that the numbers that we are looking at are all consistent. Nobody disagrees with the amount of the excess. The biggest question was, how do we decide that it is not well in excess? Because that allows us, then, to just say we followed the guidance.

MR. TAMMARA: I agree. That is one portion of the thinking. But the second portion of the thinking is what would be the potential effect of this higher population, whether the emergency preparedness, excess areas are impacted, or is there any problem with those issues? And there is no regulatory requirement from the population dose perspective. It is only from the design-basis accident point of view. It is a maximum individual and the site boundary and, then, the LPZ.

From the regulatory point, there is no requirement for the population dose to be this much. However, in the environmental area they would

evaluate the cost-to-benefit analysis, look into taking into account the population within the 50 miles. What would be the projected dose and what would be the economics, and whatever it would be? So, from that perspective, it is analyzed also. But it is a 50-mile population as opposed to the 20-mile population. So, there are different ways we have looked at it to make our frame of mind, to justify ourselves that it is acceptable. That is all I am trying to explain.

So, on that basis, we have reviewed the information, and we have independently made the confirmatory evaluations, and informed applicant's information, and it is acceptable and meets the requirements of 10 CFR Part 20 and the NUREG-0800. That is our recommendation.

MEMBER REMPE: Did you say that you did an evaluation that considered the 50-mile population?

MR. TAMMARA: No. As a partner for EIS, I mean, whoever has done the EIS, they have done those calculations.

MEMBER REMPE: And so, they did look at the excess population in those calculations and looked at the impact for the 50-mile population?

MR. TAMMARA: In their analysis, they accounted for the population that is within the 50 miles. So, therefore, I cannot say it is excess because there is no requirement there, 500 people in 50 miles, published. Because they considered the population distribution within 50 miles. They have calculated those, and they are part of EIS.

MEMBER REMPE: And they did not see any significant issue with that?

MR. TAMMARA: Right. They concluded that it is okay, or whatever, because there is no regulatory requirement of an absolute number they have to compare with, I think, in this. But, whereas, here in the FSAR Section 2 we have a guidance that within 20 miles of the plant, you have to meet, not meet, but the guidance is it should be 500.

MEMBER REMPE: Right.

MR. TAMMARA: So, what I am trying to say is, as a part of this rule, we looked at it, but even though it is higher, the impacts have been evaluated for the EIS in the general 50-mile population, so it might be okay. That is what I am trying to say.

MEMBER REMPE: You just said, "it might

be okay." You didn't say it is okay, that they looked at it and they determined it is --

MR. TAMMARA: It is okay. I mean, there is no requirement to comply with, right, in the EIS. It is a snapshot. They will say the doses are --

MEMBER REMPE: But it has been done? You keep using "will". It has been done --

MR. TAMMARA: That has been done.

MEMBER REMPE: -- and they concluded it was acceptable and --

MR. TAMMARA: Right, that's correct.

MEMBER REMPE: -- comparable to what they saw at other plants?

MR. TAMMARA: Yes, that is correct. That is correct.

MEMBER REMPE: That is what I am trying to get you to say. Okay.

MR. TAMMARA: That is correct. Because the thing is we are in two different areas.

MEMBER REMPE: Absolutely, yes.

MR. BURKHART: Yes, and this is Larry Burkhart, the Branch Chief.

We did, through the RAIs, ensure that the outcome brought into the chapter in the FSAR what was necessary to explain the rationale on the

exceedance and why it was still okay. So, it is not just living in the EIS. It is also in the FSAR, the portions that we think we need to come to this conclusion that it is acceptable.

MR. TAMMARA: Conclusion. Yes, that's correct.

MEMBER REMPE: Thank you.

MR. TAMMARA: The second section is evaluating, identifying the facilities that are within five miles of the site, and if there are any major military or ammunition facilities or airports beyond 5 miles out, so to be considered for the potential impact on the plant.

So, Section 2.2 identifies those facilities which are within 5 miles definitely, and potentially, if they have a potential for the impact beyond 5 miles also. So, the applicant has furnished all the facilities and the products, materials. Those will include the existing Florida Power power plants on the site, in addition to the storage facilities. Those have all been identified.

And the second portion of the section is to evaluate what are the potential chemicals released from those facilities that would have a potential effect on the operation of the plant, safe

operation of the plant, or safe shutdown of the plant.

Presenting all the information, we think we have concentrated on those and focused on those topics of general attention and interest. Those include pipelines, hazardous chemicals, and transportation accidents. Particularly the accidents due to the pipelines have been evaluated since the pipeline is being channeled as a supply to the fossil units onsite. But the pipeline has been evaluated from potential explosion, vapor cloud explosion, as well as the potential jet fire creating heat flux that will potentially impact the plant and plastic. So, the impacts have been independently evaluated, analyzed, and the conclusion is they don't impact adversely any of the SSCs or this plant.

In addition to that one, we have evaluated the hazardous chemicals that potentially may impact the control room habitability. In evaluating in Chapter 2, staff evaluates the concentration outside the control room and compares with the immediate dangers to the health and safety of the person concentration, i.e., alleged concentration. If that concentration for that

particular chemical exceeded the ideal alleged concentration, then that chemical would be identified to be further evaluated in the control room habitability. Because, as a part of Chapter 2, they will evaluate that chemical based upon the dilution in the control room and, also, their own requirements wherein it will sustain that concentration for two minutes or more than two minutes, where they would need any mitigating measures.

So, the chemicals we identified were chlorine and sodium hypochlorite which exceeded outside the control room, and those chemicals have been identified and passed onto the Control Room Habitability Branch to look at further and evaluate. And they have concluded in their Section 6.42 that they are acceptable.

Next slide, please.

In addition to that one, we have evaluated the potential aircraft hazards and the airways within the close distance of two miles from the site. Applicant has calculated using the DOE methodology and taking into account the crash rates. They calculated the probability, and the probability is 3.86 10 to the 4 minus 6, which is higher than

the criterion 1 10 to the 4 minus 7 per year.

Therefore, the approach they have taken is to use the conditional core damage probability of the design AP1000, and this being the initiating event, whether it would be within the acceptable limit of 1 10 to the 4 minus 7. So, in other words, the calculated probability has been considered as an initiating probability and superimposed with the conditional core damage frequency or probability of the design specification, which brought it down or which is within the limit of 1 10 to the 4 minus 7. So, that is their analysis.

Staff has acquired actual flight data within the five years from 2007 to 2012, five years of data, actual data, played that out within the five miles of this slide, all the flights, when flying within that slide. We have used that actual data and using the crash probability, the lowest of crash probability, we calculated 5.26 10 to the 4 minus 7 per year.

MEMBER STETKAR: I'm sorry. You said two things there that I need clarification on. You said all the flight data. That's military and commercial and generation aviation?

MR. TAMMARA: Exactly.

MEMBER STETKAR: And I think you said on the record that you used the lowest crash probability. Shouldn't you use --

MR. TAMMARA: That lowest means --

MEMBER STETKAR: You said on the record you said lowest. So I want to understand what you used.

MR. TAMMARA: Okay. That guide says it is 4 times 10 to the minus 10, okay.

MEMBER STETKAR: That's for in-flight crash frequency, but we have airport operations, in particular from Homestead Air Base. So what did you use for the takeoff/landing, near airport crash frequency?

MR. TAMMARA: Since is the state one, we have -- I have taken 1.86 10 to the 4 minus 8 crash mile.

MEMBER STETKAR: Per -- no, no, no. I didn't say per mile. I want it per operation. They publish crash frequencies per operations for takeoffs and landings. The miles are kind of irrelevant.

MR. TAMMARA: No, no. But when I am considering the actual flight --

MEMBER STETKAR: Right. Planes don't

fly -- planes don't fall of the sky very often. I'm talking about operations at Homestead Air Base for small and large military aircraft. What did you use for those? How did you account for crashes where F, I forgot what they fly out of there, but F something or other fighter jets trying to take off and land and not doing all that well taking off and landing.

MR. TAMMARA: That has been documented by the RAI. The applicant has given --

MEMBER STETKAR: No, no. You said you did an independent.

MR. TAMMARA: Independent calculation. No, no. I have done the independent calculation based upon the actual flight data. That's what I am saying.

MEMBER STETKAR: You were quoting to me crash frequencies for in-flight operations, which means everything is fine. Those are the 10 to the minus 8th type numbers per mile.

MR. TAMMARA: That's what I used for the crash probability, and I used the total number of flights flying through the --

MEMBER STETKAR: I guess we're not communicating very well here. I have an airport and a plane takes off from the airport and it goes up

and it has problems and it comes down, or I have a flight coming into an airport and it has problems and it goes down. Those are called takeoffs and landings.

They're called near-airport operations both on approach and departure, and the crash frequencies for those are much different and much higher, and much higher for military compared to commercial, and how did you account for those because those affect the site because it's within five miles of the airport?

MR. TAMMARA: But those flights are much smaller than the flights, number of flights which are flying per year within the five miles. When you are accounting for --

MEMBER BLEY: John's point is you have to account for all. You have to account for the ones during takeoffs and landings, you have to account for the ones overflying, but they're really a small contribution.

MEMBER STETKAR: Flights with a very low frequency of falling out of the sky.

MR. TAMMARA: I'm trying to answer your question. The applicant has done those calculations, and they came up with 3.86 and 4 minus

6.

MEMBER BLEY: Two quick things. One, be careful of your papers on the microphone as it is difficult on our transcriber, and two, John brought up some points earlier with the applicant's analysis, and he's asking you how did you check those ones on takeoffs and landings?

MR. TAMMARA: Those are from the DOE document.

MEMBER STETKAR: Yes, they are, but you said the staff did an independent confirmatory analysis and only -- the only thing I hear you saying is you did an independent confirmatory analysis of planes falling out of the sky during stable in-flight operation.

MR. TAMMARA: We reviewed their calculation. We compared the crash probabilities using the DOE document. So that is one part of the review we have done. We did not -- there is no point in using the same calculation and doing. Therefore, we have relied on what is the probability if we had used the actual flights and if those number of flights passing through, whether conservatively we computed a different way, a conservative probability number which we can

compare. That is what I have done.

MEMBER STETKAR: You calculated a number, conservative is a number that I don't -- is a word I don't understand.

MEMBER KIRCHNER: So John, may I ask to just draw him out on the analysis he did. Did you use the Miami airport and the airport space and that five years of data you looked at was for that?

MR. TAMMARA: No.

MEMBER KIRCHNER: That population of activity, flight activity?

MR. TAMMARA: When the FAA gives the data, it is all into destination no matter where it is if the path of the aircraft is within the five mile subject site. So they identified that flight, giving the origin, destination and the flight characteristic, whether it is a military, commercial or small. There are six designations.

So they gave me file for five years, giving for whatever the flight was that origin to destination. So it is flying within five miles of the site, within ten miles of the site. So I take that data, irrespective of what the origin is, what the destination is. The flight is passing over the site, okay.

So I take that number, how many number, 3,000, 27,438 in 2010. So by year, I calculate what is the total number of flights which are passing through that site.

MEMBER KIRCHNER: Right. But to John's question, where obviously the crash frequency, so to speak, is dominated by landing and takeoff operations, are most of that -- is most of that data from flights going in and out of Miami and Homestead, or as John is saying, is this data people flying high above?

FAA gives you information on flight density in each aircraft and control corridor. So if you look at, I don't have the map in front of me here. So they give you flight density per aircraft in a, you know, driving down the freeway if you will, which is what you have.

MR. TAMMARA: Okay, what's correct.

MEMBER KIRCHNER: But what I'm trying to ask is most of this data populated by landings and takeoffs? Well, I know the FAA data. So what I'm trying to elicit is is most of the data dominated by operations out of that military base and the Miami Airport?

If that data is dominated by that, then

it kind of gets to where you were going John. It's the approach, it's the takeoff and landing or --

MALE PARTICIPANT: I can't imagine there are that many flights --

MALE PARTICIPANT: Mic.

MEMBER KIRCHNER: I can't imagine that that data is dominated by flights at 35,000 feet over that location.

MR. TAMMARA: 35,000. That's what the FAA use. So therefore out of -- when you compare with the crash probabilities in DOE, there are different crash probabilities for small, commercial, and I took the lowest probable data, you know, highest probable data. 1.86 10 to the 4 minus 8 crashes per mile, which is higher and I use that one to calculate the conservative probability.

Therefore, it is a different calculation, but I'm -- rather than repeating the calculation what the applicant has done, I have done it in a different fashion to see whether my other calculation is also confirms, or conservatively confirms the probability. That's all I'm saying.

MEMBER CORRADINI: I think what my colleagues are saying is I think they understand what you did, but it's like comparing apples and

oranges.

MR. TAMMARA: Not necessarily, not necessarily.

MEMBER STETKAR: I think, I think, I think his apples are part of the applicant's apples, because the applicant also calculated in-flight crashes, as best as I can tell.

MR. TAMMARA: Right.

MEMBER STETKAR: The applicant also I think, but I'm not sure. I'm eventually going to ask for more information for the frequencies, because I did some back of the envelopes and I didn't come out with numbers that are the same as the applicant.

MR. TAMMARA: Yes.

MEMBER STETKAR: And when I say "the same," I'm not talking a couple of significant figures. I'm talking, you know, like --

MR. TAMMARA: In the same magnitude --

MEMBER STETKAR: Well, depending on what you call magnitude, you know. My exponent is a notch about theirs.

MR. MAHER: This is Bill Maher, Florida Power and Light, if I can interject here. Through the RAI process, the staff asked us exactly those

types of questions for takeoffs and landings. So just to add some historical context to this, after Andrew in '96, the Homestead Base is now a Reserve base. So flight frequency is significantly less now than when it was an active base. Also, and that base is just outside of the five mile radius.

MEMBER STETKAR: But you quote in your FSAR operations per year out of Homestead for fighter jets and you characterize them as Customs and Border Patrol and transient operations. Are those operations per year current or are those pre-Andrew?

MR. MAHER: So if I can add on to that, as part of that RAI answer, we looked at takeoffs and landings using the DOE standard for crashes, and that's where came up with our probability.

MEMBER STETKAR: I thank you. That's on the record. I've heard those words. I'd like to see how you actually used it, because I'm familiar with the DOE standard and the frequencies they use and the distributions of crashes. So if I could get that RAI, I would appreciate it. It has details of the calculation in it?

MR. TAMMARA: Right here.

MEMBER STETKAR: Okay, no. You don't --

(Simultaneous speaking.)

MR. MAHER: We can provide the RAI. We can provide the RAI.

MEMBER STETKAR: Send it through Peter please, so that we can have access to it. And you do have details for the calculations, so I can see how you distributed the takeoff and landing crashes as a function of distance from the runway?

You have a nice summary, a good summary in the FSAR actually in terms of operations and number of operations per aircraft, in terms of whether you're taking off north-northeast versus south-southwest and all that kind of stuff. So I've got a lot more information than I usually get in here. I just can't figure out how you got the numbers.

So I'm hoping in the RAI there's enough information that I can look at, to see where the numbers came from.

MR. MAHER: Not only the RAI. We should be able to provide the calculation too.

MEMBER STETKAR: Well okay. Let me take a look at the RAI first. Send it to Peter please.

CHAIRMAN RAY: Okay, all right. Continue.

MR. TAMMARA: In conclusion, staff reviewed the applicant's site-specific evaluations of potential accidents. Staff also performed an independent confirmatory calculations confirming the applicant's conclusions.

Based on the review of the applicant-provided information, responses to the requests for additional information, staff evaluations and staff's confirmatory analysis, staff found the applicant's conclusion to be acceptable, as the evaluations are in accordance with the guidance provided in 0800, and meets the regulatory requirements of 10 C.F.R. 100.2(b). That concludes my presentation.

MR. BURKHART: So this is Larry Burkhart. If I can follow up on that question I think I heard during the applicant's presentation on population distribution, one of the members asked if we used risk, and the answer is no, we don't use risk in evaluation, because it's a deterministic evaluation and we don't -- well, currently it's not in ASRP to use that.

MEMBER STETKAR: Okay, that's -- I understand that. This is not a so-called risk-informed evaluation and the staff is not obliged to

use the risk assessment as part of your deterministic conclusions.

It's just curious to me that because the design certification in this particular instance, first of all a risk assessment is required. Second of all they did do, at least for part of the scope of the PRA, they did do a Level 3 assessment of dose at the site boundary at least for internal events contribution.

That information is available. It's just curious that people apparently ignore that as part of something that they might use as another part of their tool kit, if you will, to gain confidence regarding situations like this, where there might be questions about, you know, what risk to the public might be.

So I was just trying to probe whether, you know, I didn't hear anybody say "And furthermore, we took the risk assessment and the WINDROES (phonetic) and the population density and kind of projected it out and lo and behold it's, you know, 10 to the minus 37, with six significant figures, of course. Apparently nobody, nobody uses that, which is just curious.

MEMBER BLEY: Especially when you're in

a spot of having to make a value judgment.

MEMBER STETKAR: That's right, right. It's one of these confidence builders.

MEMBER BLEY: It's one more piece of information that would help.

MEMBER STETKAR: Or confidence questioners.

MR. BURKHART: Okay, thank you.

CHAIRMAN RAY: Thank you.

MS. SCHLEICHER: Thank you, Rao. Next we will have Kevin Quinlan here to present on the staff's review for 2.3 on Meteorology.

MR. QUINLAN: Good morning.

CHAIRMAN RAY: Please proceed.

MR. QUINLAN: My name is Kevin Quinlan. I am a meteorologist in the Office of New Reactors, and I was the lead meteorological reviewer for this application.

The Section 2.3 Meteorology consisted of one supplemental item. That's a comparison table of site parameters and site characteristics, and Table 2.0-1 for departures related to operating basis wind speed, maximum normal non-coincident wet-bulb temperature, maximum safety non-coincident wet-bulb temperature, and the exclusionary or site boundary

distance. All of those departures were discussed by FPL during their presentation as well, and I'll go into a little bit more detail in my presentation.

It also consisted of five parts, each one having its own COL information item, one related to regional climatology, local meteorology, onsite meteorological measurements program, the short-term diffusion estimates and long-term diffusion estimates.

Next slide. Section 2.3.1, Regional Climatology. This is a comparison of climate-related site parameters and the site-specific site characteristics. I've highlighted the sections that I think would have been most interesting to the ACRS Committee, instead of going through every single small part, mainly the departures.

The first one is the operating basis wind speed, three second gusts. As FPL discussed in their presentation, the departure states that the 50 return period three second gust wind speed value of 150 miles per hour exceeds the AP1000 DCD set parameter value of 145 miles per hour.

The staff agrees with the value that FPL has chosen, and we confirmed that value in the same ASC Standard 705 and the wind speed amount that FPL

used as well.

Ambient air temperature and humidity. There are two departures related to this, these site characteristics. The first one is Department 2.0-2, which states that the maximum normal or 0.4 annual exceedance non-coincident wet-bulb temperature value of 81.5 exceeds the AP1000 value of 80.1.

The staff was able to confirm this value using, independently using a 37 year data set of hourly meteorological data that was collected at Homestead Air Force Base and obtained through the National Climactic Data Center.

I used the same data center to confirm the values used in the next departure for the maximum safety non-coincident wet-bulb temperature where it exceeds DCD by 1.3, 87.4 degrees versus the 86.1 degrees Fahrenheit.

The maximum tornado and hurricane wind speeds, I thought the staff would be interested in these as well. The AP1000 DCD contains a site parameter value of 300 miles per hour for the tornado wind speeds, and that is a 10 to the minus 7th per year value, compared to the Turkey Point tornado hurricane wind speed of 200 miles per hour, I'm sorry, 260 miles per hour.

For hurricanes and the tornado had 200 miles per hour. So each of the tornadoes and the hurricanes were bounded by the DCD set parameter. There was some discussion earlier about Hurricane Andrew. I agree with FPL's assessment of a one minute sustained wind speed of 167 miles per hour and two, just add one more data point.

When you convert that to a three seconds so it's an apples to apples comparison of the tornado values used at the site and the hurricane values coming out of Reg Guide 1.221, the three second gust is 204 miles per hour.

The next section is 2.3.2, Local Meteorology. The section addressed the cooling tower induced effects on temperature, moisture and salt deposition, and provided detailed information showing that the Turkey Point Units 6 and 7 meteorological data is representative of the site area.

The staff using the hourly meteorological data set from Homestead Air Force Base, compared it against wind releases at the site to make sure that the -- it's representative for wind directions and the staff used the AIRMOD model to analyze any potential effects of the cooling

towers on the switch yard at the site.

Section 2.2.3, the On-Site Meteorological Measurements Program. The applicant described the on-site program, provided a copy of the three years of resulting meteorological data, and the applicant's onsite meteorological data set met all the criteria in Reg Guide 1.23, Revision 1. In addition, the staff did go down to the site in June 2010 for a site audit and did inspect the tower, to make sure that it was as described in the SR.

Section 2.3.4, the Short Term or Accident Diffusion Estimates. This is a comparison of the atmospheric dispersion, site parameters and site characteristics. There was one departure related to this analysis, and that was what FPL described earlier, that in the DCD Table 2.2-1, it lists the EAB site parameter distance of 0.5 miles.

For FPL or for the Turkey Point site, every direction sector except for the south, southwest and southeast sectors are less than this 0.5 mile site parameter. They also presented the X/Q values for the exclusionary boundary and the LPZ, and the control room X/Q values. Even with this distance of less than 0.5 miles per hour for

most of the sectors, all of their X/Q values were still bounded by the AP1000 design.

Section 2.3.5, Long Term or Routine Diffusion Estimates. This was a comparison, again of the site parameters and site characteristics, and in COL SFAR Table 2.3.5-202, I did verify the distance and direction of each of the receptors of interest. The staff confirmed all these values using the X/Q

DOQ model and the onsite meteorological data set, and I should have mentioned for 2, 3, 4 a moment ago that the staff confirmed the EAB and LBD X/Q values using the PAVAM (phonetic) model and the onsite meteorological data set and confirmed the control room X/Q values using the ARCON96 model and the onsite meteorological data set.

For Section 2.3 for Meteorology, all of the regular requirements for Section 2.3 have been met. We have no open items and we have no confirmatory items. That's all.

MEMBER POWERS: You mentioned in a couple of cases the site exceeds the parameters for the design document, wet-bulb temperatures I think. I think that the applicant indicated that Westinghouse said that was a no, never mind. Did

you do anything to confirm that was a no, never mind?

MR. QUINLAN: In Chapter 2, we generally don't go into exactly how the temperatures are used and where in the site. We mainly confirm that they've chosen a conservative and acceptable site temperature. I did look at Part 7 departures section to see what sections were impacted by the exceedance temperatures, and it summarized that there was no adverse conditions at the site due to this exceedance.

It is a similar exceedance to one that we had in the V.C. Summer application, and I remember the result of that departure being that there was also no adverse impacts on the site.

MEMBER BLEY: You also had some wind speeds that slightly exceeded the limits.

MR. QUINLAN: Yes.

MEMBER BLEY: And where did you go to confirm that that was okay too?

MR. QUINLAN: The same Part 7 Exceedance and Departures. There's a summary, a few page summary in there about which --

MEMBER BLEY: And they evaluated against what was in the application?

MR. QUINLAN: Yes.

MEMBER KIRCHNER: Let me follow up on that one. We have a new draft Reg Guide, DG-1313 for protection against extreme wind events, and I'll quote from it down below. I think this is being entertained because it says "Reg Guide 1.76, tornado speeds, wind speeds may not bound hurricane wind speeds for certain portions of the Atlantic and Gulf Coast."

So this guide is in draft. Is there anything in this new definition of extreme wind draft reg guide that would change your analysis or is it already bounded in the confirmatory calculation?

MR. QUINLAN: My short answer is no, I don't think there's anything. I haven't actually reviewed that draft reg guide, but Reg Guide 1.221, which is related to extreme hurricane wind speeds at a frequency of 10 to the minus 7th per year was drafted because -- for that exact reason, that there are certain sections, especially along the southeast United States coast and the Gulf of Mexico, where hurricane wind speeds may bound the tornado wind speeds.

Turkey Point actually is an example of

one of those sites, where the -- at those exceedance intervals, 10 to the minus 7 return frequency, the hurricane does bound the tornados. However, the AP1000 design set parameters bound both the tornado and the hurricane wind speeds for three second gusts at 10 to the minus 7 per year frequency.

So the applicant did provide all of that information. We confirmed all of the information, and in Chapter 3 --

MEMBER KIRCHNER: How do you confirm that information in this instance?

MR. QUINLAN: In this case we used the Reg Guide to confirm. When I say "information," I mean wind speeds. We confirmed the three second gust wind speeds for the Turkey Point site, for both tornado and hurricanes.

MR. COMAR: This is Manny Comar. Can I interject something here? On the Section 3.52, tomorrow we will be talking about the high wind speed and its impact on the hurricane missile, and that's going to be addressed there.

MEMBER KIRCHNER: Thank you.

CHAIRMAN RAY: Is that all on this issue? Before you go on, I have to interject something. I'm sorry. Folks listening on the line

have sent us an email indicating that some who are on that line we can't hear of course because it's muted, have apparently -- are on the line without a muted phone, and there's a lot of background noise that's making it difficult to hear what's going on for that reason.

So we want to ask everybody without exception who's listening in on the -- to the meeting to please mute your phone, so that all who are doing so can hear clearly. Thank you. Proceed.

MR. QUINLAN: My presentation's finished, but I'd be happy to answer any additional questions that the Committee has.

CHAIRMAN RAY: Anything else? Thank you.

MR. QUINLAN: Thank you.

(Pause.)

CHAIRMAN RAY: Okay. We are now at time for the applicant to return. We're nine minutes behind. If they get started really fast, (indiscernible), which is not that bad. So we'll begin this section with the topic of Hydrologic Engineering I believe, yes.

MR. JACOBS: Paul Jacobs, Florida Power and Light. With me today is to discuss Chapter 2,

Section 2.4 Hydrologic Engineering is Dr. Stew Taylor and Dr. Mustafa Samad, both from Bechtel. Dr. Samad will discuss Sections 2.41, 2.42, 2.45 and 2.46, and Dr. Taylor will discuss Sections 2.4.12 and 2.4.13. So Mustafa, whenever you're ready. Turn the mic on. The lower button.

CHAIRMAN RAY: It's actually not a button.

MR. JACOBS: Thank you.

CHAIRMAN RAY: It's a push thing.

MR. SAMAD: Good morning. My name is Mustafa Samad. I am hydrologic engineer with Bechtel Corporation. This morning I'll present our surface water sections, some of them which are important and interesting to you. As Paul has mentioned, Section 2.41, 2.42, 2.45, 2.46, and after that Dr. Taylor will be presenting on the groundwater resources.

Next slide, please. The Turkey Point site is located near the southern tip of the peninsula of Florida and in the Everglades Drainage Basin. The site is also on the western shore of Biscayne Bay, and as shown in this figure here.

The other major hydrologic features in the vicinity of the site and in the site region are

the oceans, Atlantic Ocean and the Gulf of Mexico, and a collection of drainage canals, man-made drainage canals that was built to drain the Everglades, and they're called the Everglades National Park South Dade Conveyance System.

So the site area is very flat and mainly drains through these drainage canals. This conveys an important hydrologic feature near the site. It dampens any flood wave that propagates from the ocean and to the site, and to the east the Bay is separated from the Atlantic Ocean by a series of barrier islands, which form part of the Florida Keys and the reef chart. The Carr Sound and Bonn Sound are smaller semi-enclosed bays located south of the site.

Slide 45, please. Turkey Point Units 6 and 7 will be co-located with Turkey Points Units 1 through 5. Overall, the Turkey Point site is bounded by the Biscayne Bay to the east, the Florida City Canal from the man-made canal system to the north --

MEMBER CORRADINI: Excuse me. Could you either pull your mic a little closer or speak a little louder, because I'm having a little trouble hearing.

MR. SAMAD: Thank you.

MEMBER CORRADINI: Thanks.

MR. SAMAD: The Canal to the west, the Carr Sound Road and Carr Sound to the south, and the 6 and 7 plant will be located south of Units 3 and 4, and bounded on all four sides by the industrial wastewater facility of the cooling canals for the Turkey Point site. No surface water bodies will be used as water supply source, effluent discharge point or heat sink for Units 6 and 7. Next slide, please.

MEMBER SKILLMAN: Mustafa, let me ask this question. Those canals constitute very significant waterways. What is the total length of those canals and what is the approximate velocity of the cooling water that is being transported through those canals?

MR. SAMAD: You mean the cooling canals?

MEMBER SKILLMAN: Uh-huh.

MR. SAMAD: The cooling canal is five miles long, and about a mile wide on average, and they are actually a canal that goes back and forth. So from north to south and back south-north. So have a pathway for the heat dissipation.

The head difference between the northern

and southern portion is about, if I recall it correct; I have to confirm it to you, is about a couple of feet between the northern -- I mean the canal that receives the discharged water and the portion of the canal that goes back into the cooling system.

The system is a closed water body. It is not treated as the water of the United States. So this is an industrial wastewater facility, and this is -- the canal system does not interact with the safety function of Units 6 and 7.

MEMBER BROWN: Could I ask, what are the -- the canal is the dotted lines?

MR. SAMAD: These are actually very narrow canals.

MEMBER BROWN: Oh those are the canals. Okay, that's fine. That's all I wanted to know was where the canals were. I couldn't, no labels or they don't show up on your graph.

MEMBER SKILLMAN: So the total length of the cooling ligament if you will is approximately how much?

MR. SAMAD: I have to come back to you on that.

MEMBER SKILLMAN: It appears it must be

miles.

MALE PARTICIPANT: 168 miles.

MEMBER SKILLMAN: Thank you. I figured a number approximately like that. Thank you, thanks.

MR. SAMAD: If I may, next slide please. Oh actually on this slide, Slide 46, yeah. Units 6 and 7 slight elevation will be raised and surrounded by a retaining wall structure. The retaining wall will range between elevations 19 feet and 25.5 feet in North American Vertical Datum of 1988. This is the standard vertical datum used for the plant.

Top of the region wall elevations range from 20 feet to 21.5 feet in NAVD '88. This change in elevation is actually not gradual. It's one side of the retaining wall would have a fixed elevation; other side has a different elevation, and the design grid elevation for all safety-related structures, systems and components at the site is at 26 feet NAVD '88, and this elevation corresponds to the AP1000 DCD plant elevation of 100 feet.

So this elevation is actually tied with the safety-related elevation for entrance and openings for the plant. The safety-related structures for the AP1000 design at the containment

or the reactor building, and auxiliary building.

AP1000 reactor design employs a safety-related passive containment cooling, which serves as the ultimate heat sink for design basis accident events. The system does not depend on offsite water sources to perform its safety function.

Next slide, please. The west-east cross section of the raised plant area is shown in this figure to explain site elevations. The cross section passes through the centers of Units 6 and 7. The finished grade elevation of 19 feet NAVD '88 will be at the retaining wall and the highest elevation, the finished grade elevation of 25.5 feet NAVD '88 is at the center of the two reactor buildings.

The plan creates design build elevation of 26 feet, is the lowest elevation of plant entrances and openings at the reactor and also at buildings. An enlargement of the eastern retaining wall towards the Biscayne Bay is shown here as well. The top elevation of the retaining wall on this side is 21.5 feet NAVD '88.

East of the retaining wall is the return cooling canal, and east of that is an existing earthen berm.

MEMBER KIRCHNER: Is that earthen berm an engineered berm, or is that a natural outcropping?

MR. SAMAD: This probably was kind of a dug out fill. It's not engineered and it is not -- it's not really accounted for any of the assessment that we did on flooding.

MEMBER KIRCHNER: Okay, thank you.

MR. SAMAD: But it is a landmark there existing.

MEMBER KIRCHNER: Thank you.

MR. SAMAD: Slide 48, please, 49. Okay, yeah. A review of historical data from streams and tide gauges near the site indicates that the maximum flood water level near the site is associated with storm surge events, and aside from the storm surge, the local intense precipitation during a storm event is also critical for the site.

And beyond that, potential tsunamis generated in the Atlantic Ocean and all the Gulf of Mexico could affect the site. A summary of evaluated flood elevations is presented in this slide, the historical maximum flood elevation and plant design grade elevation.

As can be seen here, the maximum flood

elevation or the design basis flood elevation is 24.8 feet NAVD '88, which results from the probable maximum storm surge. Flood elevations due to local intense precipitation and probable maximum tsunami are 24.5 feet and 14 feet NAVD '88.

The maximum observed water level in Biscayne Bay is about 15.4 feet NAVD '88 from Hurricane Andrew. This elevation was observed near the middle of the Bay. It's approximately 30 miles north of the site, and on a building wall as a watermark. If you want --

MEMBER SKILLMAN: So there have been other hurricanes that have hit the east coast, some very serious hurricanes. Is the maximum observed simply because of the proximity of Andrew in 1992 to our deliberations today, or is that the highest recorded ever for this geographical location?

MR. SAMAD: This is the highest recorded for the record available in that geographic location. Basically, we're looking at elevations within the Biscayne Bay, and this is the highest one. The next one came from the hurricane in 1945, which -- yeah, which is lower than the elevation recorded for Andrew.

MEMBER SKILLMAN: Thank you.

MR. SAMAD: The AP1000 DCD requests that the plant create -- the design grid elevation is higher than the design basis flood elevation at the site, and as we see here, the design basis floor elevation is 1.2 feet lower than the design plant elevation. So the DCD requirement is met here. Effect of local intense precipitation --

MEMBER KIRCHNER: Could you -- pardon me. Could you just repeat your summary versus the design criteria?

MR. SAMAD: Yeah. Go back on slide, please. Yeah. So what you see here is that the DCD requests that the flood elevation, design basis flood elevation should be lower than the design plant elevation, which is the DCD Elevation 100, and in our case this is 26 feet NAVD '88.

That elevation we compare with the design basis flood elevation, which is 24.8 feet. So we see our plant elevation is 1.2 feet above the design basis floor elevation.

MEMBER KIRCHNER: So how much confidence then do you have in that? 1.X feet doesn't sound like a lot of free board?

MR. SAMAD: The DCD criteria does not require that 1.2 feet free board at all. It just

compares with the same elevation, because the criteria is said in that way. If you meet that criteria, the plant is safe. So whatever margin we have here is actually added margin for the plant and we can talk about a little bit more how we define that design basis flood elevation, which will be coming with next slides.

MEMBER RICCARDELLA: But do I interpret from this that that design basis flood is about ten feet higher than anything that's ever been observed?

MR. SAMAD: Actually yes, and I will just supplement that by saying that the observation is 13 miles north of the site. At the site for the same hurricane, the flood elevation was about six feet in elevated --

MR. FRANZONE: Just to clarify too, Hurricane Andrew, the eye actually went over the plant, and so the surges just north of the hurricane are the highest. So like he said, it was about 13 miles north of the plant.

CHAIRMAN RAY: So I think the point is that the margin that perhaps Walter's looking for is in the design basis flood elevation, not the difference between that and the plant grade.

MR. SAMAD: The design basis plant

elevation should be about the design basis flood elevation point.

CHAIRMAN RAY: Right, right. But the question was is it enough above, and the answer is well, there's margin reflected in that number 24.8.

MR. SAMAD: Yes. This is actually a margin. This is --

CHAIRMAN RAY: Yeah.

MR. SAMAD: It's not necessary to meet the requirement of the DCD.

MR. JACOBS: Paul Jacobs, FPL. The actual design grade elevation of 100, the DCD requires the plant grade to be a half a foot less than plant grade, the outside grade to the facility. So we meet the DCD half a foot and I understand that 1.2 feet is not a lot, but we met the requirements of .05 feet.

CHAIRMAN RAY: Thank you.

MR. SAMAD: The effect of local intense precipitation was evaluated. The maximum precipitation depths are obtained from National Oceanic and Atmospheric Administration Hydrologic Meteorological reports. The obtained one hour point or one square mile local PMP intensity is 19.14 inches, and this is lower than the corresponding

AP1000 DCD limit of 20.7 inches. So in this respect, also we meet the DCD criteria.

During the local PMP event, the side grade would allow runoff to drain away from SSEs. The local PMP flooding analysis is considered all underground normal storm water drainage features to be completely blocked. The maximum local PMP elevation evaluated is 24.5 feet NAVD '88, which is 1.5 feet lower than the plant design grade elevation of 26 feet.

Next slide, please. The Atlantic Ocean is the source of hurricane storm surges near the site, but the storm surge generated by probable maximum hurricane would propagate through the Biscayne Bay to affect the site.

The PMH or Probable Maximum Hurricane is defined as the hypothetical steady state hurricane with a combination of meteorological parameters that will give the highest sustained wind speed that can probably occur at the specified coastal location.

The PMH parameters are obtained from NOAA technical report NWS-23, and I used for computing the storm surge elevation at the site. Storm surge computation is performed with an antecedent water levels, the initial water level for

the computation. That includes a ten percent exceedance high stream tide and initial rise, as required by Reg Guide 1.59.

We also added a long term sea level rise to the antecedent water level. The ten exceedance high stream tide is the high tide level that is equaled or exceeded by ten percent of maximum monthly tides over a continuous period of 21 years.

When the ten percent exceedance high stream tide is estimated from predicted tide, Reg Guide 1.59 recommends adding a separate contribution of initial rise. But when this ten percent exceedance high stream tide is estimated from surge tide base data, then the additional initial rise of sea level anomaly adjustment is not necessary.

For Units 6 and 7, the ten percent exceedance high stream tide and rise are conservatively obtained from Reg Guide 1.59 for a location very close to the site, and this -- this elevation is 2.6 feet NAVD '88.

The historical data from nearby tide gauges are also analyzed to account for a projected sea level rise for the plant and design objective, which we just say as design life also. As recommended in the tracer, tidal records of 50 years

or longer are necessary to understand the change in sea level rise at the location.

Based on long period data records available from nearby tide gauges, a nominal sea level rise of 1 foot is selected for the plant design objective of 60 years, and this compares to the estimated or calculated sea level rise of about 0.8 foot for 100 years. So it's essentially 0.8 foot for the tide gauge data that we used in this estimate.

In combining these two contributions, we get antecedent water level as 3.6 feet NAVD '88. So from the model results that we obtained a computed ten average maximum wind speed of 159 miles per hour, and then we used this wind speed to estimate the impacts from wind generated waves.

The probable maximum storm surge, including wave runup, is obtained as 24.8 feet NAVD '88. This includes the feedbacks from a coincidental wave. The wave height is 15.4 feet, and the wave period is 5.1 seconds. The still water level of the storm surge is 21.1 feet NAVD '88, and the wave runup is 3.7 feet.

So this section also requires, the Section 2.45 also requests an assessment of surge

impacts and we evaluated there is no surge impacts from Biscayne Bay or the makeup water reserve.

Next slide, please. Potential tsunami sources that may generated tsunamis and affect Units 6 and 7 site are identified from historical tsunami runup data. The two tsunami source generator mechanisms important to the site are the submarine landslides and earthquakes.

The submarine landslide sources that may affect the site are post-related, based on published research and data. The three most important sources for the site are identified as the number one, the Cape Fear Submarine Landslide Complex in the U.S. Atlantic margin.

These numbers are actually marked on this figure, on the slide for location. The number two is the Submarine Landslide Complex on Florida escarpment, on the edge of the Florida back in the Gulf of Mexico, and number three the submarine landslide on the western margin of the state of Florida, along the Great Bahama Bank.

These locations, as I said, are shown here. The maximum tsunami elevation after accounting for the landslide in the initial water displacement and the propagation of the slide, came

up to be 13.5 feet NAVD '88, and resulting from the postulated landslide at Great Bahama Bank.

MEMBER BLEY: I thought over near the Azores or maybe it's a little further north, there was a volcanic and volcanic-induced slide region that could affect our east coast pretty significantly.

MR. SAMAD: That would be on the eastern, the eastern shore of the Atlantic Ocean. It's the other side of the Atlantic Ocean. That is on the other side of the Atlantic Ocean, the eastern side of the Atlantic Ocean, the European coast.

There are two potentially sources nearly the same location. One is the volcanic, the Caldera Collapse, that collapsed --

MEMBER BLEY: Maybe it was an extreme calculation I saw that projected that coming all the way over. Somebody did that a few years ago.

MR. SAMAD: Yeah. There was a publication on that, projecting to be -- having 30 feet of tsunami water level at the Miami coast.

MEMBER BLEY: Yeah.

MR. SAMAD: Which has been disputed by many researchers and more recent studies actually have shown that the assumptions made in formulating

the propagation model has some I would say very conservative features.

MEMBER BLEY: More than conservative I'll bet.

MR. SAMAD: It did not have a -- yeah. So later studies have actually come up with a much lower number for the Florida coast.

MEMBER BLEY: Okay, good. My memory was there were some ignoring of dampening things going on in the beginning that was a real problem.

MR. SAMAD: Exactly, yeah. The word dissipation was not included in that.

MEMBER BLEY: Yeah.

MR. SAMAD: For the earthquake source though, we have one source located very close to that, the Caldera Collapse source, and our source is the source of the 1755 Portugal or Lisbon earthquake, which created a very significant tsunami.

Although there is no record of tsunami runup on U.S. coast, but north of U.S. and south of U.S. coasts have been affected by that, and the recent studies on this are still ongoing. There are many studies that are ongoing on that.

(indiscernible) depending on where the

exact source was located and barrier by the islands very close from the source may have actually sheltered the U.S. coast from having a direct impact. So the simulations could predict the similar magnitude of tsunamis on the northern side and the Canadian coast, and on the south in the Caribbean coast.

So and we took one such studies as our source to define the tsunami generated, which is the Azores/Gilbrator plate boundary. This is the plate boundary between the ocean and African plates. Then we found that to be our PMT, the probable maximum tsunami for our site and our simulation, based on published results from the deep water to the site location, I came up with total maximum tsunami elevation of 14 feet NAVD '88.

The other earthquake source that we considered is from the North Caribbean Subduction Zone, and we found that the Azores/Gilbrator plate boundary tsunami really bounds the tsunami from the North Caribbean Subduction Zone.

MEMBER BLEY: I hate to do this. We've pursued this with respect to river flooding. In terms of tsunami, what does probable maximum tsunami really mean?

MR. SAMAD: That's a good question actually. The probable maximum, the definition for probable maximum in terms of both hurricane or storm surge or (indiscernible) and same applies for tsunami is that it's an event that can probably occur, and which should not be exceeded by any other event so --

MEMBER BLEY: So it's a judgmental-based definition?

MR. SAMAD: That's correct, yeah. And for example, for the storm surge purposes, there is guidance available from the NRC to define the parameters that would create that total maximum hurricane. But for tsunami, no such guidance still available.

MEMBER KIRCHNER: Could you summarize all of these results versus your site map? Would I understand it properly if I concluded that the event with the likely highest flooding would be this storm surge of 24.8 feet, and that would come over the retaining wall and flood the plant area three or four feet or something on that order. That's correct?

MR. SAMAD: That's correct. Yeah, I would ask you to also kindly consider the slide on

48, page 48, Slide 48, which provides the summary. So this is the summary elevation of side grade, along with the major flood-causing mechanisms and flood elevation from those mechanisms.

And this is then can be compared with Slide 47, which shows the cross-section. The still water level, as shown in Slide 47, is actually 21.1 feet, which is lower than the prop elevation of the retaining wall. So only portion of the wave coming in would be running up to the sides.

MEMBER KIRCHNER: Thank you.

MR. SAMAD: And that ends my presentation, and next would be on the groundwater.

CHAIRMAN RAY: Any further questions?

(No response.)

CHAIRMAN RAY: Please proceed.

MR. TAYLOR: Thank you, Mustafa. Again, my name is Stewart Taylor. I'm a hydrologist for the Bechtel Corporation. I'm going to be talking about Subsection 2.4.12 first, and this presentation will address the following topics that are of interest to groundwater.

I'll talk about the hydrostatic framework on a regional and site-specific basis, the maximum groundwater level as it relates to the DCD

site parameter. I'll discuss radial collector wells, which you've heard before serve as a backup water supply for cooling tower makeup. Finally, the wastewater disposal via deep well injection will be discussed in the Section 11.2 presentation.

Could I have Slide 53 please? I'll first describe the regional hydrostratigraphic column. I'm doing this because it sets the context for later discussions. This particular illustration or graphic was produced by the U.S. Geological Survey, and I'd like to bring your attention to the fifth column, which depicts the different hydrostratigraphic units.

You see that there's three major hydrogeologic units. These include the surficial aquifer system, the intermediate confining unit and the Floridan aquifer system, and the Floridan aquifer system itself has the following subunits:

The Upper Floridan aquifer, the Middle Confining Unit and the Lower Floridan aquifer. The surficial aquifer system is relevant for our discussion today for purposes of establishing the maximum groundwater level, assessing radial collector well operation, and evaluating an accident release of radioactive liquid effluent,

which I'll talk about in Subsection 2.4.13.

And then the Boulder Zone, which is part of the Lower Floridan aquifer, is a highly transmissive interval, and this is the target interval for deep well injection of waste water, and this will be discussed more in the Section 11.2 present. The Boulder Zone itself you can see is depicted in the red on this particular illustration.

Slide 54. I'll now talk on a more site-specific basis for each of the major hydrogeologic units. The surficial aquifer system consists of the Biscayne aquifer and Tamiami Formation. These are comprised of undifferentiated sand, silt, clays, shell, shelly limestone at the site. It was characterized to be on average about 220 feet thick.

The water that's in the surficial aquifer is saline and is unsuitable for potable water supply. Underneath the surficial aquifer system we encountered the intermediate confining unit. It's comprised of a formation referred to as the Hawthorn Group. It's a clay deposit. It's about 700 to 1,000 feet thick at the Turkey Point site.

Beneath the intermediate confining unit is the Floridan aquifer system. It's comprised of

interbedded carbonite rocks. It has the three subunits that I mentioned previously, the Upper Floridan aquifer. The water quality of the unit is brackish. There's a middle confining unit is about -- is an aquitard.

It's about 1,000 feet thick at the site, and then the -- at the base is the Lower Floridan aquifer. This has saline water quality. The salinity is equivalent to that of sea water, and this unit includes the Boulder Zone, which I mentioned earlier. Slide 55.

MEMBER CORRADINI: Just so I understand. So the -- as we get down below the intermediate aquifer, it's brackish to salt water. Am I understanding that correctly?

MR. TAYLOR: That's correct. So the --

MEMBER CORRADINI: That is the type of -- what is the intermediate aquifer system, fresh water or also brackish?

MR. TAYLOR: I'm sorry, the intermediate confining units?

MEMBER CORRADINI: The intermediate aquifer system.

(Simultaneous speaking.)

MR. TAYLOR: Are you looking at Slide

53?

MEMBER CORRADINI: Yes sir.

MR. TAYLOR: Okay. So this is referred to as a regional generalized hydrostratigraphic column. So depending on where you happen to be in South Florida, in some areas that might be a confining unit. In other areas, it might be a small aquifer system. At the Turkey Point site, it's a confining unit.

MEMBER CORRADINI: And that's also brackish or that's also fresh water? Help me out. Or it varies.

MR. TAYLOR: I don't have a specific answer to that question. I mean it's an aquitard so it --

MEMBER CORRADINI: It's a what?

MR. TAYLOR: It's an aquitard, so it does not transmit water. So it's from a perspective of like serving as a water supply.

MEMBER CORRADINI: It's not?

MR. TAYLOR: It's not.

MEMBER CORRADINI: Okay. That's where I was going. Thank you.

MR. TAYLOR: Yes. So we're on Slide 55. So I'd like to summarize the groundwater modeling

results that were used to establish the maximum groundwater level at the site. The AP1000 DCD site parameter requires that groundwater be two feet or more below the plant grade.

As was previously discussed by others, the existing site grade is just above sea level. However, once the site is developed and built up, the maximum site grade will be raised to 25.5 feet, with the plant grade being at 26 feet. To assess compliance with the DCD site parameter, we developed a groundwater model to estimate the maximum post-construction groundwater elevation.

This model involved developing a conceptual and numerical model of the surficial aquifer system. This model reflected the site in its post-construction state, with the Turkey Point area built up and all the constructed features represented in the model. The results of this model, we found the maximum post-construction groundwater level to be about three feet above sea level, three feet NAVD '88, and this evaluation that we conducted considered potential for sea level rise.

It also considered postulated failure of the makeup water reservoir system, both of which

could affect groundwater levels at the site. So the results, which are representative results are depicted in an illustration on the slide. In the end, our maximum groundwater level is about 23 feet below the plant grade, and we therefore conclude that the DCD site parameter related to groundwater depth, we meet that criterion.

MEMBER BLEY: Something I don't know anything about, but maybe you can point me to who does, looks at it, when you have the amount of water near the surface that we have here, how does that affect seismic events impact on the plant? Who looks at that?

MR. TAYLOR: Well, and Mustafa you can correct me, but I think in terms of a seiche, that's one of the considerations.

MEMBER POWERS: He's probably more worried about liquefaction. He probably is.

MR. TAYLOR: A liquefaction? Okay.

(Laughter.)

MR. TUNON-SANJUR: Hi. This is Lee Tunon-Sanjur of Westinghouse. Westinghouse evaluated the response at different groundwater levels for the AP1000. So one of the cases in the AP1000 is reaching the elevation 100, which is

beyond the 98 feet that would be required. So the groundwater level effects on the floor response spectra is accounted for in the AP1000.

MEMBER CORRADINI: Okay. Maybe other people understood that. I'm not helped.

MR. TUNON-SANJUR: Okay, I'm sorry. So flooding changes the water level up to the top elevation grade level of the Turkey FP amount. They will then -- the response is then compared. The design of the AP1000 and we'll show you tomorrow envelopes, the Turkey Point seismic response.

So the fact that the flooding level or the groundwater level has been accounted for in our design. I'm not --

MEMBER POWERS: Well, I think we're -- Chairman Bley is worried about his width, the loose material you have. In a lot of water, do you get liquefaction in a seismic event?

MALE PARTICIPANT: Or not.

MEMBER POWERS: Or not.

MR. FRANZONE: Okay. This is Steve Franzone. We specifically address that tomorrow, the liquefaction question because we evaluated that for the site. However --

MEMBER BLEY: Tomorrow will be just

fine. This answer left me the way Dr. Corradini was left.

MR. FRANZONE: Okay.

MEMBER POWERS: What have you done with respect to erosion of the -- underground erosion of the limestone that creates sink holes in the material?

MR. TAYLOR: That's also a topic that will be addressed in Section --

MEMBER POWERS: In due course.

MR. TAYLOR: Yes. All right. Slide 57 please. I'm sorry, 55, 56. So now you had heard previously about the radial collector well system, and then I'd like to describe that system in a little more detail and how it affects the groundwater system.

So first of all, FPL has partnered with Miami Dade County to supply treated wastewater as a primary source of clean water, makeup water, and we referred to this as reclaimed water.

If reclaimed water's not available in sufficient quantity or quality, then the radial collector well system will serve as the backup water supply for cooling tower makeup water. It's been located and designed to minimize environment

impacts.

In addition to the radial collector well system, there is a makeup water reservoir on site which has several days of makeup water storage that could operate even before the radial collection well system is required. The radial collector well system itself has a capacity of about 86,000 gallons per minute.

It includes four wells on the Turkey Point peninsula. That's that peninsula that juts out into Biscayne Bay. For operation of radial collector well system, normal operation only three wells would be required to supply the required makeup water. A fourth well would serve as a backup.

If you're not familiar with radial collector well, each consists of a central caisson. These are all located on the Turkey Point peninsula. There are radial laterals that emanate radially from the caisson. They would extend out underneath Biscayne Bay.

The laterals themselves may be up to 900 feet in length, and would be located 25 to 40 feet below the Bay bottom. And in terms -- recall the radial collector well system is a backup water

supply, and the radial collector well operation is limited by permit to no more than 60 days in any 12 month period.

We use the surficial aquifer groundwater model that I described previously to assess the impacts of radial collector well operation. We have seen that the system operated continuously, in other words 365 days a year instead of the 60 days a year that its operation is permitted.

So this assumption of continuous operation overestimates the impact on the groundwater system. So the model results, representative model results are shown in an illustration on this slide. This shows, this particular slide shows the drawdown in the upper most model layer. That outermost contour, the red contour represents the 0.1 foot drawdown, and you can see that the extent of the drawdown encompasses the Units 1 through 5 plant area as well as the Turkey Point peninsula.

MEMBER BALLINGER: I was trying to go through the math last night. From Miami-Dade you get about round numbers, 35,000 gallons a minute. The radial collector wells are 86,000 gallons per minute. You need three out of four, which is on the

order of 60,000 gallons a minute. Is there just an additional margin? Is it the minimum 35,000 gallons a minute that you need?

MR. TAYLOR: The difference. The difference is the reclaimed water is essentially fresh water. So you can cycle it up further in the cooling tower for cycles of concentration.

MEMBER BALLINGER: Oh, okay.

MR. TAYLOR: Whereas the radial collector wells draw out salt water. They can be cycled I think one and a half times.

MR. JACOBS: Paul Jacobs, FPL. The cooling towers operated when they're reclaimed operator on the four cycles of concentration, whereas when you're on the radial collector wells, you're at 1.5. So the makeup required is substantially more.

MEMBER BALLINGER: Well, the math comes out right?

MR. JACOBS: The math comes -- yes, the math comes out.

MEMBER BALLINGER: Okay, okay. Thank you.

MR. TAYLOR: The final point that I'd like to make on the radial collector well system,

the model results were analyzed to determine what the source of the water was in the radial collector well, and this analysis indicated about 98 percent of the water originated from Biscayne Bay, which would be -- is intuitive because the laterals extend out under Biscayne Bay, and about two percent of that water would originate from inlet sources.

MEMBER RICCARDELLA: Excuse me. What does that previous bullet that says "Drawdown limited to Units 1 to 5" mean?

MR. TAYLOR: What I mean by that is that if you look at the illustration on Slide 56, those contours represent the drawdown, and by drawdown it's the difference when you're not pumping the radial collector well system, versus when you're pumping it at its capacity.

So when the system would be turned on, pumping at 86,000 GPM, and if you were to have piezometers in that particular geological area, you would see a tenth of a foot drop around those contours. The point of this illustration is that the extent of that drawdown, that does not go beyond that unified Turkey Point area.

MEMBER RICCARDELLA: You're not pumping down under homes.

MR. TAYLOR: All right. I'd like to move on now to Subsection 2.4.13, Accidental Releases of Radioactive Liquid Effluents in Ground and Surface Waters. We followed -- in doing this evaluation, we followed the approach in Branch Technical Position 11-6. For groundwater, we postulated the failure of an effluent holding tank, which is located in the lowest level of the AP1000 auxiliary building.

We looked at different conceptual models to find which model bounded the dose, and the primary model we looked considered a release from the auxiliary building, a release to groundwater, a groundwater transport discharge to the industrial wastewater facility or cooling canal system, and then eventual migration from the wastewater facility to Biscayne Bay.

In this particular case, we assumed that the industrial wastewater facility was not operating and -- I'm sorry, was operating, and the radial collector well system was assumed to be not operational. We used the surficial aquifer model to track where such a release would go.

The particle tracking results are shown in the upper illustration on the right side of this

slide, and in this case you can see that a release from either Units 6 or 7 would track to the south or southeast and discharge to the industrial wastewater facility, and then eventually find its way to Biscayne Bay.

MEMBER SKILLMAN: Stewart, what controls are on the concentrations of isotopes in the effluent holdup tank, such that your final criteria are met? What ensures that what you're beginning with in terms of release is at or below its limit?

MR. TAYLOR: Well, for the source term itself, I mean the AP1000, Westinghouse looked at the different tanks and determined that the effluent holding tank was the bounding source term, in terms of activity for the suite of radionuclides that were considered. How that might be monitored I don't know.

MEMBER SKILLMAN: Okay, thank you.

MR. ORTHEN: Excuse me. Rick Orthen, FPL. The concentrations in the effluent holdup tanks --

MALE PARTICIPANT: You have to get closer.

MR. ORTHEN: Concentrations in the effluent holdup tanks would be administratively

controlled through a future program that the plant would have to develop, to maintain compliance with the rad waste building and aux building inventory limits. So it's administratively controlled.

MEMBER SKILLMAN: Thank you, I understand.

MEMBER BROWN: On that subject, can you just -- I'm trying to picture where this tank is in the auxiliary building and go back to the previous speaker and think about where the water levels might wind up if you had a surge on site. Where is this located in the auxiliary building? Is it below grade or is it --

MR. TAYLOR: It is below grade. I don't know the specifics of how far below grade, but it is on the lowest level of the auxiliary building.

MEMBER BROWN: So is that, to follow up then, say you had a surge on site and it flooded the site to some level, what two or three feet. Is there access to this auxiliary building from surface water?

MR. SAMAD: This is Mustafa Samad. I'll just respond to that question by saying that the access to the auxiliary building would be at the DCD elevation 100, which is plant elevation 26 feet NAVD

'88, which is about the design basis plant elevation. So under this extreme probable maximum storm surge event, the water -- there is no pathway to ingress into the auxiliary building for the surface waters.

MEMBER BROWN: So then what is the pathway to get into the groundwater from the auxiliary building?

MR. TAYLOR: Yeah. This is Stewart Taylor again. It is -- it's a postulated failure. We followed the branch position 11-6. We assume that 80 percent of the tank volume is instantaneously released and available. There's no credit taking for any kind of sumps that are in the auxiliary building. There's no credit taking for any of the concrete impeding the flow.

So it's very conservative in that no credit is taken for any of those mechanisms that would normally hold up that liquid.

MEMBER BROWN: Thank you.

MR. TAYLOR: Uh-huh.

MEMBER CHU: A quick question. You said all criteria related to the accidental releases have been met. What criteria are you talking about here?

MR. TAYLOR: Okay. I will address that

on the next slide.

MEMBER CHU: Oh okay.

MR. TAYLOR: If I can do that. So just continuing, we did look at, in terms of the exposure scenario, you remember earlier that virtually all of the site is, you know, there's Biscayne Bay on one side. I talked about the water quality in the surficial aquifer. It's saving water quality.

So in terms of an exposure scenario, there's no potable water sources on site that anyone could consume drinking water from. So therefore we considered an exposure scenario that's based on consumption of fish invertebrates that are harvested from Biscayne Bay.

MEMBER STETKAR: Stewart, can you help me? Can you go back to the previous slide? I was just looking at the -- I know nothing about hydrology so educate me. You did both of the cases on this picture with the radial collector well system off.

MR. TAYLOR: Right.

MEMBER STETKAR: How would those profiles change if it was on? Do they go up to the northeast more?

MR. TAYLOR: There would be -- I mean we

did the simulations. I mean we presented --

MEMBER STETKAR: I'm just thinking about travel times and, you know, filtrations, because you're going to get to --

MR. TAYLOR: Yeah. Actually, we ran -- we ran cases 2 and Cases 4, which I'm not showing here. But those simulations assume that the radial collector well system was operating, and there was a tendency to, you know, the radial collector wells are located to the northeast of Units 6 and 7.

MEMBER STETKAR: Yeah.

MR. TAYLOR: There was a little bit of tendency to draw the particles in that direction. But in terms of -- in terms of the what was bounding in terms of dose, those two scenarios I just described were less severe --

MEMBER STETKAR: Okay. That's all I was looking for, okay.

MR. TAYLOR: --than the ones I'm describing here.

MEMBER STETKAR: Sorry.

MR. TAYLOR: So we used, I mentioned the exposure pathway was consumption of fish invertebrates harvested from Biscayne Bay. Again, we used the model to calculate travel times and

calculate radionuclide concentrations from the postulated release. Using those peak concentrations, we performed a dose calculation. We used the bioaccumulation factors from Regulatory Guide 1.109.

We used dietary factors that are published in the Res Rad User Manual, and we used dose conversion factors that were provided in the EPA guidance document. The results, we looked at multiple scenarios, but the bounding dose from the bounding scenario, which happened to be the particles tracking to the east with the industrial wastewater facility off, those doses were below the regulatory limits of 10 C.F.R. Part 20-1301.

So that was -- I had the question about what we were comparing our compliance against, and that's the regulation. So we concluded that the dose is met from accidental release of effluent groundwater, and to complete the picture from a surface water perspective, the AP1000 has no outdoor tanks that contain radioactive material.

Therefore, an accidental release of radioactive liquid effluent to surface water was not plausible and was not considered further. And I believe that's all I have.

MEMBER BLEY: All floor drains inside the plant are directed elsewhere?

MR. TAYLOR: I believe --

MEMBER BLEY: Directed into outside water streams?

(Simultaneous speaking.)

MR. TAYLOR: I believe the floor drains inside go to sumps, that they're not directed outside.

MEMBER BLEY: And the pumpdown paths from the sumps?

MR. FRANZONE: Steve Franzone. Yes. So they would all pump down the sump tank inside the ops building or whatever building we're discussing, right.

MEMBER BLEY: Okay.

CHAIRMAN RAY: All right. Any more questions?

(No response.)

CHAIRMAN RAY: Thanks very much. At this time, we'll be recessing. Wait a minute, not quite yet. I'm going to just say that we're on schedule, close to it. We have quite a large group here, and so I'm going to ask us to come back at five minutes after 1:00, just to make sure

everybody's got a full hour to take their lunch break. We stand in recess.

(Whereupon, the above-entitled matter went off the record at 12:02 p.m. and resumed at 1:04 p.m.)

MEMBER RAY: We're back on the record, resume this afternoon's session. We'll be hearing from the staff about the same subject area in hydrologic engineering in a second. But, first, one of our members wishes to make a statement.

MEMBER MARCH-LEUBA: Yes. I just recently retired from Oak Ridge National Laboratory, and for 12 months I'm conflicted on any presentations by ORNL members, so I'm going to leave for your presentation and come back later.

MEMBER RAY: Thank you, Jose.

All right. Lisa, are you going to direct us here?

MS. SCHLEICHER: Okay. Welcome back. Next, we'll have the staff's review for Section 2.4 on hydrologic engineering. So the technical review team for Section 2.4 was led by Joseph Giacinto here from the Hydrology and Meteorology Branch at the NRC, and there is also contractor support from Oak Ridge National Laboratories. We have Ellen Smith

and Melanie Mayes. And then we also have Patrick Lynett from the Southern California -- University of Southern California, who is on the bridge line.

MEMBER RAY: And we will not open that, because of the disruption that it creates just due to background noise, until the others have made the presentation, if that's all right. Or did you want to go? It's --

MS. SCHLEICHER: It's my understanding that that's the plan --

MEMBER RAY: Yes.

MS. SCHLEICHER: -- to open the bridge line, so he can give his presentation.

MEMBER RAY: Right. But we'll do that at the end, or did you want to do it sooner? What's the sequence you want to use?

MS. SCHLEICHER: I believe his slides are embedded in -- within the staff's presentation, so if it's --

MR. GIACINTO: Right after we finish with storm surge, we'd open it up for his slide, and then we could shut it off and open it up for questions again.

MEMBER RAY: Okay. Well, we don't want to open and close it. So because there are other

people on the line and we're not going to want them to participate until at the end of this session, we can't leave it open, and we don't want to keep opening it and closing it. So if you could organize things in such a way that his input can be received and he can respond to any questions from members, then we'll close the line until the end of the day. That's the only way we can do it.

The other way would have been, but it's too late now -- it's what we normally do -- is you ask ahead of time for a separate line for somebody who wants to participate. We set that up, and then he can stay on as much as he wants to. But with there not being a separate line, and the only line is a public line, we can't use it other than the way I just now described, which is we'll open it for his statement, any questions, and then we'll close it and it's over. Okay?

MS. SCHLEICHER: Okay.

MEMBER RAY: Next time, like I say, ask us ahead of time and we'll set up a line that -- a dedicated line for him ahead of time, but it's too late to do that now.

MS. SCHLEICHER: Stay open for the questions for the entire day, or just Section 2.4?

MEMBER RAY: It will just be questions in the wake of whatever it is he will be saying, not for this whole section.

MS. SCHLEICHER: Okay.

MEMBER RAY: All right?

MS. SCHLEICHER: Okay.

MEMBER RAY: It's simply too difficult to keep a public line open when we are trying to conduct a meeting because naturally people want to comment, the line makes noise, and so on. But a dedicated line, we could have set up and left open. We're actually trying now.

I asked that we try, but I was told it's not possible. We'll see what happens.

MS. SCHLEICHER: Okay. Sorry about that.

MEMBER RAY: Perhaps we can do that. But if -- if we don't, then we'll do it the way we said, and you actually say, "Okay. It's time for us to open the line, so he can participate," and then -- and then we'll have to close it again because it's not fair to the other people to say, "You can't talk now."

CHAIRMAN STETKAR: We're going to see if we can get the other line set up. Somebody is going

to have to contact -- as long as we have a telephone number that we can reach him to tell him what number to call in on, I think we'll be okay.

MEMBER RAY: I was told we didn't have his phone number, and that's why we couldn't do it.

MR. GIACINTO: Actually, we can get it.

CHAIRMAN STETKAR: Yes. I have his email.

MEMBER RAY: Well, all right. You guys do whatever you want. But if we can get a separate phone line, we'll do it, and that way he can just be part of the group. But we can't just have one person on a public line be part of the group and everybody else be quiet. Okay?

So, with that, Lisa?

MS. SCHLEICHER: All right. So I'll turn it over to Joe.

MR. GIACINTO: Okay. Good afternoon. I'm Joe Giacinto, the team lead for the FSAR Unit, Section 2.4, for the COL application. As to my background, I have a bachelor's in geology/geophysics and a master's in hydrology from the University of Arizona. I am a registered professional geologist with 25 years of experience in hydrology and environmental field, and eight

years of experience with NRC's Office of New Reactors in the Hydrology and Meteorology Branch.

We have with us Ellen Smith, the surface water lead, and Patrick Lynett on the phone for Tsunami, and Melanie Mayes as the lead for groundwater. And they will introduce their selves shortly and just prior to the presentation of their respective topics.

We will start with an overview of the staff's work and background for the site, which is located within the Atlantic coastal plain of Miami-Dade County, approximately 25 miles south of Miami, as shown on the slide.

The hydrologic engineering staff conducted a visit at Turkey Point March 22nd through 25th in 2010. Topics included site setting, hydrologic site characteristic, and associated document reviews. And the staff coordinated the review of state and federal agencies, including the Florida Department of the Environment, USGS, U.S. Army Corps of Engineers, and NOAA.

The staff performed an independent review and confirmatory analysis as explained in the upcoming slides.

I'd just like to add that, to get to

this point, the staff has had multiple interactions with the applicant, including meetings, requests for additional information, and various discussions. And all information requests are resolved, and no further information is needed from the applicant.

Next slide, please.

Given the coastal location and tropical climate of south Florida, there is no potential issues related to river flooding or ice effects. The staff's Section 2.4 review focused on the topics of local intense precipitation, storm surge, tsunami, groundwater, and will briefly touch on, as part of the groundwater discussion, an accidental release of radionuclides from the tank failure.

Here you see an aerial --

MEMBER RAY: Excuse me. Let me interrupt you again on this administrative thing. We are going to try and set up a line with him. But if we do, you're going to hear dial tone, okay? Don't -- just go on as best you can or wait until it's over. But it's the only way we can do it. Normally, we'd do it during a break or something, but we're trying to get it done now.

MR. GIACINTO: Okay. Just to add there is an aerial view there looking towards the

southwest. And then on the next slide is an overhead view illustrating the surface water features of the site.

Next slide, please.

Here is the site map, which you've seen previously. Here you see the site and surface water features, showing the 5,900-acre closed loop industrial wastewater facility, or IWF. The IWF consists of shallow, approximately three-foot deep canals. It's the long, thin lines that you see running north to south in the figure. And they're used for the cooling of the existing units with the deeper, approximately 18-feet deep, collector and return canals.

The interceptor ditch to the west of the IWF, industrial wastewater facility, was constructed at the same time as the IWF, and it was designed to limit the influence of IWF water on the shallow groundwater quality to the west. Water is pumped from the interceptor ditch to the IWF cooling canals when needed to maintain a water level in the ditch that is lower than the water level in the L-3lE canal.

The isolated interceptor ditch is approximately 20 feet deep, as is the L-31E canal.

So the L-31E canal is a levy-barrow canal constructed in the 1960s primarily to mitigate salinity intrusion west of the canal and is used for surface drainage as part of the canal system managed by the Southwest Florida Management District and the U.S. Army Corps of Engineers.

The radial collector wells would be an alternative source, an independent source of makeup water for the proposed plant operations for non-safety-related circulating water system cooling. The primary source would be the reclaimed water from Miami-Dade water and sewage district, and the collector wells would be approximately 25 to 40 feet below the bottom of Biscayne Bay, with the construction characteristics as outlined previously by the applicant.

Okay. Just to avoid any confusion, I'd just like to add that all of the elevations that we'll talk about today are in the North American Vertical Datum of 1988, commonly referred to as NAVD 88.

So with that background to set the stage, we'll go into a few more details of our review, starting with Ellen Smith on the surface water.

MS. SMITH: Okay. Thank you, Joe. I'm Ellen Smith. I've been on the research staff at the Oak Ridge National Laboratory in the Environmental Sciences Division there for over 34 years. My academic background is in geology and hydrology, and I received a master's degree in water resources management from the University of Wisconsin at Madison.

My experience includes groundwater modeling and review of modeling studies for a variety of different physical and chemical systems. I was the ORNL lead for review of several flood hazard topics for Turkey Point, including local intense precipitation and storm surge.

This slide covers local intense precipitation. As the applicant noted, the probable maximum precipitation event considered for this analysis was 19.4 inches in one hour with a peak rainfall of 6.2 inches in five minutes.

Our review of the analysis of local intense precipitation found that the applicant's analysis was conservative, and it was consistent with NRC guidance. The event that was analyzed has a higher rainfall intensity than any event that has ever been observed globally for the time periods of

one hour and five minutes, which illustrates the conservatism that is --

MEMBER POWERS: When you say "globally," are you speaking --

MS. SMITH: I'm speaking of Earth.

MEMBER POWERS: Earth.

MS. SMITH: Yes. There is no record --

MEMBER POWERS: Why are we using something that is more than ever been observed on the planet?

MS. SMITH: We're using guidance that was established by Nuclear Regulatory Commission based on analyses by the National Weather Service that determine the highest potential, the probable maximum precipitation, based on meteorological conditions, temperature, and so forth, for various points in the United States.

So this is a conservative guide, and the applicant used it, and their analysis successfully demonstrated that the -- this site could handle that amount of water without exceeding the critical elevation of 26.0 feet.

The water from that storm would be successfully conveyed off the site by sloping surfaces and drainage swales. Our staff did

confirmatory modeling of the licensee -- of the applicant's analysis that confirmed the finding that water levels would remain 1.5 feet below the design grade, even with a very extreme rainfall event that was considered in the analysis, because this was NRC guidance.

MEMBER POWERS: So you think it's just mislabeled; it's an improbable maximum precipitation.

MR. GIACINTO: It's based on guidance for the hydrological -- hydro meteorological reports. It's the theoretical maximum that could be achieved. It's not really a quantity that has ever been observed. That's the guidance and that's the --

MEMBER POWERS: You know, we can make it 10 feet in 30 seconds, too, and that would certainly bound things. I mean, this is a fanciful number.

MS. SMITH: Well, it may be a fanciful number, but the purpose is to ensure that the site that --

MEMBER POWERS: Like I said, if I --

MS. SMITH: -- this kind of event --

MEMBER POWERS: -- if I made it 10 feet in 30 seconds, I would definitely assure the site --

I mean, I don't think you're accomplishing anything here.

MS. SMITH: Okay. Well, that's an issue for the guidance, I'm afraid, not for our review.

Next slide?

Okay. On to the topic of storm surge. The Turkey Point site faces the Atlantic Ocean. Hurricane storm surge is a well-known potential flood hazard for this site. It is just eight miles south of the landfall of Hurricane Andrew, which was a Category 5 storm and one of the largest hurricanes ever to make landfall on the continental United States.

As the applicant indicated earlier, the highest observed storm surge for Hurricane Andrew was 15.4 feet at a location marked by the blue arrow. It's about 10 miles north of the Turkey Point site. That was the highest storm surge elevation on record for the state of Florida, and as the storm surge elevation at Turkey Point was about 3.4 feet. So this was significant background for our review, for the applicant's analysis and our review of their analysis of storm surge at the site.

Next slide.

MEMBER POWERS: Hurricane Andrew is not

a bounding hurricane?

MS. SMITH: No.

MEMBER POWERS: So we could have a worse hurricane?

MS. SMITH: Well, the applicant's analysis followed the NRC guidance, which called for analysis of a more extreme hurricane than Hurricane Andrew. The applicant used the probable maximum hurricane that was determined, again, using National Weather Service methods defined in NRC guidance.

The probable maximum hurricane event defined that way is at least as severe as any that has been observed in the Atlantic, as measured in particular by the atmospheric pressure differential between the storm center and the storm periphery. It also had a lower central pressure than any storm on U.S. record and a higher wind speed. So that was the basis for analysis. We're trying to do a conservative analysis.

The applicant chose the SLOSH model to evaluate storm surge from the event. This is a model that was developed by NOAA and used by FEMA for projecting storm surge and hurricane emergencies. And it's used for nuclear safety plant reviews, which are determined to be consistent with

NRC's guidance for this topic.

In the two decades after the model was published in 1992, it has been put to the test against a number of real hurricanes that weren't included in the data set that was used in establishing the model. To satisfy ourselves that SLOSH, as a model, would provide good predictions or conservative predictions of storm surge for Turkey Point, we reviewed a number of studies that compared SLOSH model estimates of storm surge with the surges observed in actual storms.

The review included applicant-provided proprietary studies that were made available to us in a reading room, as well as published studies by the Army Corps and other organizations. While these studies found that SLOSH model estimates for some storms were not as good as they -- folks hoped they would be, the Turkey Point site did not have physical characteristics that are associated with lower predictive success of that model.

An applicant-provided analysis using SLOSH of Hurricane Andrew found good agreement between the model-predicted storm surge from Andrew and the observed storm surge from that event. That and other elements of our review gave us a good

basis for expecting that SLOSH would give conservative results for Turkey Point.

In addition, the applicant followed NRC guidance to determine the conservatively high antecedent water level for inclusion in the model. They added together the effects of the 10 percent exceedance spring -- high spring tides, sea level anomaly, and an allowance for long-term sea level rise, to provide a total antecedent water level, 3.6 feet.

Their modeling using SLOSH included analysis of ranges of values for the various variable storm parameters that were required as input to SLOSH. This included parameter values for storms more severe than the probable maximum hurricane that was determined by National Weather Service methods. Using this approach, after adding a 20 percent allowance for model uncertainty to the highest storm surge prediction for the probable maximum hurricane, then adding wave run-up from 150 mile an hour winds, the applicant's analysis found a maximum water surface elevation of 24.8 feet, which is below the -- 1.2 feet below the site design grade, as discussed earlier today.

Next slide.

Further confidence in the applicant's results was obtained from a comparison of the SLOSH results with results from a research study by the Army Corps of Engineers that used ADCIRC, which is a more sophisticated storm surge modeling code than SLOSH.

The Army Corps study developed storm surge elevations for the Turkey Point site for a range of storms. Comparison of the results of that study found very good agreement between SLOSH results and the ADCIRC results for a storm that had a calculated recurrence of 10 to the minus 7 annually. The results actually differed by 0.14 to 1.2 inches, which is amazing agreement.

MEMBER POWERS: Probably coincidental.

MS. SMITH: Based on our reviews, the staff has accepted the applicant's conclusion that the probable maximum hurricane event does not affect the safety-related structures, systems, and components of the Turkey Point Units 6 and 7 facility.

MEMBER POWERS: Is the situation with ADCIRC that you get the Corps to run these calculations for you, or do you have a code, or what is the situation with this?

MS. SMITH: Well, this was a study, really, independent of this review. And I think Joe can --

MR. GIACINTO: It was actually a study for the -- a study done for the entire Gulf Coast area. And Turkey Point happened to be included, as was Levy and a couple other sites in there. So in that study, they did a detailed analysis. You know, with ADCIRC it's a little bit more advanced than SLOSH in terms of the solvers and numerics. So it's more numerically accurate, I would say, than a SLOSH model, and it gives better results.

You know, a 10 to the minus 7 recurrence is pretty darn low, and we have great confidence in that, the value the applicant --

MEMBER POWERS: Well, I mean, that's one of those probability mumbo-jumbo that some of my colleagues actually believe in. But he didn't respond to it, I --

(Laughter.)

MEMBER POWERS: -- but I'm more interested in the physics that's incorporated in the models and what their reality is. And what you're telling me is you're probably the wrong people to ask.

MR. GIACINTO: Well, what you will find is there is -- it starts to reach an asymptote, not simply because of the physics; you can only get a storm so big. The pressure can only go so low, and so at a 10 to the minus 7, we're right at that area where it's -- the asymptote is starting to come into play, and that's just --

MEMBER POWERS: Some of these things, like ground acceleration, your uncertainties get huge --

MR. GIACINTO: Yes.

MEMBER POWERS: -- as you get out into these low probability events. Do you have a feeling what the uncertainty is on these things? They didn't -- the study didn't do an uncertainty -- disciplined uncertainty analysis?

MS. SMITH: The ADCIRC analysis, actually the Corps used ADCIRC to calculate the probabilities of the various storms that it was modeling. They assigned probabilities to the -- or they -- no, they didn't assign probabilities to input parameters. They created ranges of values for the input parameters, and it was a more sophisticated model than SLOSH. It's -- 25 years ago, we didn't have the computational capabilities we have now. So they looked at ranges of values --

MEMBER POWERS: There's an open debate on whether that's a good thing or a bad thing.

MS. SMITH: -- and they determined -- and they did make determinations of the individual probabilities of the different physical conditions that were input to the model, so the 10 to the minus 7 probability for a particular storm was the joint probability of the events, of the conditions considered as input to the model.

MEMBER POWERS: I understand.

MEMBER CHU: If you had done the same analysis before Hurricane Andrew hit, what would you get in your result? I'm trying to figure out how much of your result is based on the existence of you already know Hurricane Andrew was there. So would you be able to predict before Hurricane Andrew?

MS. SMITH: With respect to SLOSH, it's my understanding that the input parameters are those that were established when the model was first developed. We didn't examine whether they had changed any -- whether they had tweaked the model to adapt to the findings of specific storms that occurred later.

But to the -- it's my understanding that the data set used in the model is basically that

that was established in the early '90s when the model was published. So Hurricane Andrew really was a storm that happened afterwards that was predicted by the existing code. We could -- I believe we could look into that and find out whether there were any changes --

MEMBER CHU: Thank you.

MS. SMITH: -- made to the input data.

MR. GIACINTO: Andrew was incorporated in the Army Corps study. So, you know, given that and the recurrence interval, there's a high degree of confidence in the results.

MEMBER KIRCHNER: May I ask, do you do a deterministic hurricane? By which I mean you pick a hurricane of a certain strength, et cetera, and then do the calculation deterministically to see what the water level rise is? I'm troubled with the 10 to the minus 7th, and I'm trying to put that in -- it seems like you are doing a deterministic -- like a design basis event for the hurricane. What does the 10 to the minus 7th have to do with it?

MS. SMITH: The 10 to the minus --

MEMBER KIRCHNER: For the purposes of the analysis that was presented. I can see using it in PRA down the road, but that's another matter.

MS. SMITH: Now, the ADCIRC analysis was not done for the purpose of this review. It was done for the separate purpose of assisting the Commission in understanding the probability and consequences of extreme storm surge events. So the SLOSH analysis was based on deterministic hurricane parameters based on guidance, and that was the analysis that the applicant provided in accordance with NRC guidance.

The ADCIRC analysis is really something that was almost serendipitously available for use as an additional comparator. And so it really -- for our purposes, it really just builds confidence in results that had been provided by the applicant. There was no probability assigned to the NWS 23 or the NWS-defined storm that was used in SLOSH.

MEMBER POWERS: I think my understanding is --

MS. SMITH: So this is just an additional study that provided confirmatory strength.

MEMBER POWERS: My understanding is what was done in the ADCIRC circulation is they had characteristics that affect the storm. They had ranges for them. They sampled those ranges. The

combination that corresponds to 10 to the minus 7 gave them this result that compared so well to the SLOSH. Is that roughly correct?

MS. SMITH: Yes. And this is just one of a number of combinations that correspond to --

MEMBER POWERS: Yes.

MS. SMITH: -- probability. This is --

MEMBER POWERS: There is a whole phased phase that --

MS. SMITH: Yes. This was the highest surge from a 10 to the minus 7 storm in that study.

MEMBER RICCARDELLA: But as I understand it, the surge you are using is almost 25 feet, and the maximum observed during Hurricane Andrew was 15 feet. So --

MS. SMITH: Right.

MEMBER RICCARDELLA: So we're 10 feet higher than that. And is that what is a 10 to the minus 7th event? Is that what -- essentially?

MS. SMITH: You're asking whether Andrew is 10 to the minus 7th, or whether --

MEMBER RICCARDELLA: No. No. Whether this -- the 10-feet high -- a storm surge 10 feet higher than Andrew is a 10 to the minus 7th event. Is that a correct interpretation?

MS. SMITH: That may be. I don't know that we have -- we can say that firmly, but that was an indication of the ADCIRC study, so --

MEMBER POWERS: If my understanding of the study is right, that there is a combination of storm parameters that could -- at 10 to the minus 7 probability that could produce a surge of 25 feet. I can probably find a 10 to the minus 7th combination of hurricane tendencies that would produce 12 feet. Okay? Because they would produce different things at different locations and things like that.

MEMBER BLEY: But we shouldn't jump to the conclusion that because the storm that was analyzed was a 10 to the minus 7 storm, it generated this, that the total frequency of storms that could generate that height is 10 to the minus 7. There might be any number of other storms --

MEMBER POWERS: This is not --

MEMBER BLEY: -- that could generate the same thing.

MEMBER POWERS: This is not a probabilistic study of storms.

MEMBER BLEY: Right.

MEMBER POWERS: This is a probabilistic

study of the numerics in a code.

MEMBER BLEY: Or a storm, yes.

MEMBER POWERS: Well, I mean, I think Ellen characterizes it exactly correctly. This adds some confidence that you are able to take advantage of somebody else's work and compare it. I'm not out of the ballpark. I think it's great. But you can't use it to do much more than just what they've done.

MEMBER BLEY: But what they've done is useful, and I would just, for the record, note that this was the same kind of thing that Mr. Stetkar was asking about earlier when he asked if they looked at the -- in another area looked at the probabilistic results to see if it gave them confidence in their judgments. I think it's a good use.

MEMBER KIRCHNER: Since we have experts here, wasn't there a very severe storm in the '30s, a hurricane, that hit lower -- that same lower area? I think the northern part of the Keys in particular? And does that -- how does that factor in versus Andrew and others? I'm struggling with the 10 to the minus 7th. I'm not debating --

MEMBER POWERS: They are going --

MEMBER KIRCHNER: -- your analysis.

MEMBER POWERS: -- frequencies.

MS. SMITH: I don't remember the numbers, but Andrew was the most severe affecting this -- this part of the coast anyway, so -- okay.

MEMBER RAY: Proceed, please.

MS. SMITH: We may have time for more questions later, but seeing none, I guess it's time to pass things over to Pat Lynette on the phone.

MEMBER RAY: Okay. Well, if we've been successful, and I expect we have been -- the staff has been working on it -- can we open the dedicated line, then, to have our next participant? And, Lisa, you'll speak to him?

MR. LYNETTE: Am I on?

MEMBER RAY: Yes, you are. And Lisa will direct things from here.

MS. SCHLEICHER: So next we will have Patrick Lynette from University of Southern California give his expertise on the tsunami evaluation.

MR. LYNETTE: Excellent. Good afternoon, and thanks for accommodating me. I'm Pat Lynette. I'm a professor of civil engineering at the University of Southern California, and an independent contractor to the NRC for the tsunami analysis.

A little bit about me, I received a Ph.D. from Cornell University in 2002. My background is in examination of extreme coastal events, and I have been involved in most of the tsunami field surveys and investigations that have taken place around the world over the past 15 years or so.

For this project, I was part of a team of scientists and engineers from the USGS and academia tasked to perform an independent determination of the probable maximum tsunami, or the PMT, for Turkey Point.

The general NRC approach for determining the PMT is to review historical events, develop a set of potential mechanisms or sources that could generate a tsunami at the site, and then model those sources to determine the tsunami hazard at Turkey Point using site-specific information, such as high resolution, dosimetry, and topography.

From the review of historical data and available geological information, the staff identified earthquakes and landslides with the potential to generate a tsunami that could reach a site. These included large landslides along the local continental shelf in the Florida Straits,

large landslides along the Atlantic margin to the north of Turkey Point, large earthquakes and landslides in the Caribbean, and large, distant volcanic flank collapse from the Canary Islands across the Atlantic.

Based on geophysical data and information in the technical literature, volumes of landslides and earthquake magnitudes are specified and are considered conservative. The landslide tsunamis control the PMT at Turkey Point. The largest source of conservatism in the approach is the assumption that all of the initial potential energy of the water displaced by a landslide is converted directly into tsunami energy. And so this represents a physical upper limit on the side of the generated tsunami given a landslide volume.

Using hydrodynamic modeling with numerical tools that are in widespread use in the tsunami community, the tsunami propagation and evolution are modeled and site-specific tsunami characteristics are predicted. From this modeling, the PMT has a maximum water elevation of about 10-1/2 feet, including the 10 percent exceedance high tide, which includes sea level anomaly, 100 years of historical sea level rise. The total PMT has an

elevation of 14.1 feet, which is in very, very close agreement with the applicant's value.

So the PMT water level is less than the maximum storm surge and well below plant design grade, so the tsunami water levels will not impact the maximum flood elevations at the site.

MEMBER RAY: Can I interject a question at this time?

MR. LYNETTE: Of course.

MEMBER RAY: This is the Chairman of the subcommittee. The subcommittee has looked at a landslide-generated tsunami in some detail at the Levy site on the west coast. Have you had any opportunity to look at that, and could you compare the two relative assumptions made as far as spreading, and those sorts of things, that we went into in some depth for Levy?

MR. LYNETTE: Sure. So the analysis between Levy and Turkey Point are identical. The main difference between the two sites is simply the specification of sources. So when we talk about Levy, we are concerned with landslides inside the Gulf of Mexico. You have the shelf around the Gulf of Mexico, we have sea floor information from which we can identify old landslides and remodel those

landslides with some conservatism.

And so, in general, that's the same approach that we use in Turkey Point. Since we're on the other side of the Gulf of Mexico, our sources are different. So instead of specifying landslides in the Gulf of Mexico, we specify landslides along the Atlantic continental shelf in the Caribbean and in the Atlantic.

But the general approach is the same; it's just how we choose our sources between those two is different. Once we specify those sources, the modeling approaches between Levy and Turkey Point are, again, identical. We use hydrodynamic tsunami models that include defraction spreading, refractions, non-linearity, all these things that we expect to be very important for large tsunamis approaching the shoreline.

MEMBER RAY: Okay. Well, good. I just wanted to make that connection because we spent a half a day or so on that at Levy. And the methodologies, and so on, if you're familiar with them and are able to say that the same were used here, that's helpful. Thank you.

MR. LYNETTE: Yes, I can, because in fact I did the NRC analysis for Levy as well.

So I was not going to talk anymore off the slide. I'm happy to answer any questions.

MEMBER RAY: That's fine. And because this is a dedicated line, I'll leave it to Lisa as to whether you should remain on the line or mute again. But it just popped there, so maybe we should put it on mute. Is there anything more you'd like him to say? You want him to stay on the line and available, I assume.

MS. SCHLEICHER: Right. So next we'll turn it over to Melanie for the groundwater.

MEMBER RAY: We do have another question here.

MEMBER RICCARDELLA: I have a question. The applicant's analysis considered earthquake sources as well as landslides, and actually that was a higher -- gave a higher number than the landslide sources. Could you comment on that, please?

MR. LYNETTE: So we included earthquake sources as well, including a magnitude 9-plus earthquake in the Caribbean, which is a very, very large earthquake. For our analysis, it turns out that that earthquake-tsunami is less than our landslide sources. And between our analysis and the applicant's analysis there are slight differences in

how we specify the initial conditions, and the mechanism of generating the tsunami by the landslide. And so that accounts for the differences in which tsunami source controls the PMT.

MEMBER RICCARDELLA: Thank you.

MEMBER RAY: Okay. Then, Lisa, because of all this popping, we'll close this line. But there may be other questions later, and we can open it up again if that's all right.

MS. SCHLEICHER: Sounds good.

MEMBER RAY: Okay. Fine. Thank you.

MS. SCHLEICHER: So next Melanie Mayes will present on the groundwater portion.

MS. MAYES: Hi. I'm Melanie Mayes. I'm a senior staff scientist and team leader at Oak Ridge National Lab. I have been employed there since 2002. My background is in geology involving radionuclide transport in subsurface materials. And so for this area I did the analyses of Section 2.4.1.2, which is groundwater, and 2.4.1.3, which is the radioactive release scenarios.

And so I'll describe those results very quickly, in a very high level overview of this. In general, we reviewed what the applicant provided and we did some confirmatory analysis. And, in general,

we found that their analysis was conservative and consistent with NRC guidance. Specifically, some of our findings were that, in general, flow is from west to east in the vicinity of the site.

Local groundwater elevations are very much controlled by the surface water bodies in the area, including Biscayne Bay, the industrial wastewater facility on the plant site, the interceptor ditch, which is just to the west, and a variety of south Florida water management district canals.

We examined the applicant's subsurface pathways analysis, and we confirmed that groundwater discharge could occur in the industrial wastewater facility and Biscayne Bay. Both of those discharge points were considered in the radionuclide transport analysis, and in neither case -- in all of those cases we found that the applicant's analysis was conservative and that there was not a dose that exceeded NRC guidance.

We also found that the applicant followed the Branch Technical Position 11-6 in constructing their scenario for the radioactive release. Part of our work was also to look at the maximum groundwater elevation at the site, as this

can influence construction dewatering or permanent dewatering. And, of course, that -- it needs to be consistent with the DCD of the AP1000. And what we found was confirmatory of what the applicant provided, which was the maximum site groundwater level was three feet.

Next slide, please.

We also looked at the deep well injection of blowdown and effluent from the site. And what the applicant plans to do is to inject blowdown and effluent into the so-called boulder zone of the Lower Floridan Aquifer, and you can see it at the bottom of this figure. It's the one in light blue. You can also see that it's about 3,000 feet below the land surface.

The boulder zone is actually not composed of boulders, but it is a very, very high permeability zone of an aquifer and transmissivities there are very, very high. The groundwater in this zone is saline at the site. And just above the boulder zone is the Middle Floridan Confining Unit. This is a quite thick unit. It's about 1,500 feet thick, and there are a variety of intervals, most of which are considered confining units. So that unit would provide the confining strata for the effluent

that is disposed of in the underlying boulder zone.

MEMBER SKILLMAN: Melanie, is this Upper or the Middle Floridan Confining Unit generally a uniform plain, or is this an undulating plain where it is very thick in some locations and very thin in other locations?

MS. MAYES: It ranges across all of Florida. In general, one of the -- I'm looking in front of me at a hydrostratigraphic column from USGS study, and it listed as being about 500 to 1,500 feet thick in south Florida. So it's quite thick. All of these units are going to be fairly heterogeneous in terms of their -- how they change as a function of both vertical and horizontal distances.

Overall, in comparison to the overlying Upper Floridan Aquifer and the Lower Floridan Aquifer, this one is considered a confining unit. So its permeability is quite less.

MEMBER SKILLMAN: Thank you.

MEMBER RAY: "Its" refers precisely to what now? Its confining?

MS. MAYES: It refers to the permeability or the ability of the unit to transmit groundwater through there. So the issue of concern

is if -- since the blowdown and effluent will be disposed of in the underlying Lower Floridan Strata, if there is permeability in the Middle Floridan Confining Unit, that could allow upward transmission of that blowdown into the Upper Floridan --

MEMBER RAY: And so "its" is referring to the Middle Floridan --

MS. MAYES: That's correct.

MEMBER RAY: -- in your sentence. I just couldn't make that connection.

MS. MAYES: Okay.

MEMBER RAY: Okay.

MS. MAYES: The boulder zone is -- has been used extensively in south Florida for disposal of a variety of mostly municipal waste effluents. Turkey Point proposes to use 12 Class 1 underground injection-controlled wells and six dual-zone monitoring wells. And you can see where those will be emplaced on this diagram, too. There's a lowering monitoring interval in the confining unit, and there is an upper monitoring interval in the Upper Floridan Aquifer.

MEMBER REMPE: Remind me, I'm just curious. I'm sure I could find it in the documentation, but these wells, can you talk about

how they're formed? I mean, they just drill a hole in the ground, or how is it created?

MS. MAYES: The injection wells?

MEMBER REMPE: Uh-huh.

MS. MAYES: The injection wells are -- these are very large wells. I mean, they are --

MEMBER REMPE: But what is the diameter of them?

MS. MAYES: I don't know if that -- we do have that on a backup side?

MR. FRANZONE: Hello. Steve Franzone, Florida Power and Light. We do talk about in detail in Section 11 the construction, and they start off 54 inches in diameter and they go down to approximately 18 inch at the bottom of the well. It's 3,000 feet, so --

MEMBER REMPE: Are they lined at all, or are they just --

MR. FRANZONE: Yes.

MEMBER REMPE: What are they lined with?

MR. FRANZONE: Yes. Well, I'll let Paul --

MR. JACOBS: Paul Jacobs, FPL. They're not lined per se, but they have casings. They have a series of casings from the largest to the

smallest. The injection pipe is a fiberglass-reinforced pipe, which is the 18-inch pipe that Steve referred to. I have a nice diagram that shows how we -- what the well and section looks like, and a description of the various casings and where they are set.

MEMBER RAY: We'll go into this I'm sure in a lot of detail. It's relevant here, of course, in terms of leakage that might occur before the -- you get to the bottom. But as long as we're assured you're going to discuss it --

MR. JACOBS: Yes. What you'll see is how we construct them to avoid any of the leakage.

MEMBER RAY: Yes.

MEMBER REMPE: Thank you.

MEMBER KIRCHNER: Let me -- I think it's a relevant question. Is there any experience/history of doing produced water injection from oil operations in this area of Florida?

MS. MAYES: Yes. Yes, there is. There are over 100 -- I don't think those are Class 1 wells. I think those might be classified as a different class, but they're similar. There are over 100 Class 1 wells in south Florida, in fact.

MEMBER KIRCHNER: So there is a

precedent of injecting --

MS. MAYES: There is a lot of precedent of this, yes.

MEMBER KIRCHNER: -- produced water. Produced water being a byproduct of oil recovery.

MS. MAYES: And so this will actually be addressed in a lot more detail in the 11.2 section, which will come up right after this one. And so if there aren't any further questions about this, we can move on to the next slide.

And so this is a summary diagram, and what you can see, this is site elevation. The design grade is at 26 feet. The storm surge that we talked about, the maximum one that we found was 24.8; tsunami at 14.1; maximum groundwater, which is the section I just discussed, was at three feet; and Hurricane Andrew, which is 10 miles north of the site, is at 15.4 feet.

And so that's the end of my presentation. I'll be glad to take questions.

MEMBER RAY: Yes. I'm not sure that this is the place to ask the question. But because you had that cross-section diagram up there, and you made a number of comments, one of the things we will have some interest in, or at least some of us will,

is how -- what's the potential for there to be a smaller, more confined space into which injection would occur than is assumed.

You described a boulder zone as well understood. It sounds like it's well understood in terms of its extent and characteristics of it, and so on, and the confinement that exists from the Middle Floridan. But one question would be, are there -- is there potential for there to be isolated pockets that don't have the transmissivity that the boulder zone has laterally, for example?

MS. MAYES: Yes. It's fairly site-specific, actually. In general, this across in fact all of Florida, there is areas that it's very suitable for this. Miami-Dade uses this extensively, as do many other wastewater treatment plants in the area.

In general, that has not been the problem of concern. Sometimes there has been upward migration that has been observed at some of these sites, but it has generally been attributed not to the lack of transmissivity, but in fact due to faulty well construction and that kind of activity. Yes.

MEMBER RAY: Could you tell a layman

what -- how a geologist views the -- how this was formed? I'm trying to get in my mind what uniformity we should assume laterally for these layers?

MS. MAYES: You know, in general, we don't know nearly as much as we would like. It's 3,000 feet deep. It costs a lot of money to get down there that deep to take a really close look, right?

But so it's -- you know, it is going to be heterogeneous, but of course this whole area is carbonate platform. You know, this is built up by deposition of sediments and also precipitation of limestone associated with coral reefs and sea life. So it is going to be fairly heterogeneous.

And what has happened over the geologic history is that when sea level rises, you get growth of the platform, and so we're building land. But when sea level drops, what happens is you will get essentially development of caverns and things like that. So this particular -- this particular area potentially has some of that kind of history, but then once sea level rises back up, then things re-precipitate.

MEMBER RAY: Well, that is something I'd

just note to my colleagues. The assumption generally is, in most everything that we look at, that there is uniformity and extensive lateral transmissivity. So penetrating inadvertently a fairly small pocket where things could accumulate more than we are assuming they would isn't really addressed, and that's why your comment about the heterogeneity is relevant here.

In other words, what do we know about what we are injecting into 3,000 feet down? The fact that a lot of people have done it for a long time gives some degree of understanding, certainly. But you never can be certain that you know about this particular place I guess, unless you knew that indeed this is very uniform, very subject to not having any of the kind of thing that I'm trying to describe, probably very poorly, but nevertheless it's an area of concern that we want to try and put to rest.

MR. FRANZONE: Again, this is Steve Franzone. We do have a slide that talks about the extent of the boulder zone. And if you bring that question back up at that point, I think we can have a further discussion and answer some of those questions.

MEMBER RAY: Yes. Thank you, Steve. We certainly will, but we have also spent quite a bit of time before this meeting looking at what we know about it, and anything more we can know about it is going to be valuable to us.

MEMBER BALLINGER: This may also come up later as well. But since there has been a large history of injection into this zone for other reasons, and I think that from what I have been able to read there is an intersection with the ocean floor in general at around 3,000 feet off coast, what is the direction of general flow of the aquifer? Is there any evidence that stuff injected from Miami into this zone eventually ends up in the ocean?

MS. MAYES: Let me look at that figure.

MR. GIACINTO: I can answer some of that. There has been a lot of studies in terms of the flow directions. It's basically, as you know, as you go down deeper, it's warmer. And there is a convective flow going on.

MEMBER BALLINGER: Okay.

MR. GIACINTO: And the current understanding is that the convection of sea water through the -- and it's a very slow process. I

mean, we're talking thousands of years for sea water to come through the Florida boulder zone and eventually rise up due to heat and density differences in terms of the convection shells. And these would be huge shells, and the circulation would be on the order of, you know, maybe five to 10,000 years, so --

MEMBER BALLINGER: Okay. So the time scale is just enormous.

MR. GIACINTO: It's extremely slow circulation pattern.

MEMBER BALLINGER: Beyond my lifetime.

MR. GIACINTO: Yes.

MR. TAYLOR: Excuse me. This is Stewart Taylor, maybe if I could add to that. Can you hear me?

MEMBER RAY: Yes.

MR. TAYLOR: So there have been some studies done by the U.S. Geological Survey that investigated the regional flow patterns in the boulder zone, and through some dating of some natural isotopes they have determined that there is an inward or landward grading, very, very shallow grading on -- I think we're at 10 to the minus 6 or less inland, and, you know, associated with that

very long travel times.

MEMBER BALLINGER: Thank you.

MEMBER RAY: Well, as I said at the beginning, this is something we haven't dealt with before, so it's a challenge. Anything more?

MR. GIACINTO: No. That concludes our presentation, if there are no more questions.

MEMBER RAY: Okay. Members? All right. Remarkably, and I will attribute it to the very excellent and careful planning done, we are on schedule.

And we'll have one more presentation, which may blow all of that to pieces, before we have a break, and it's the applicant presentation on the Liquid Waste Management System. If that goes longer than planned, we may take a break and then resume it after the break.

Thank you.

Greetings. Paul, you're going to take charge, are you?

MR. JACOBS: Yes, I am. This afternoon we're going to discuss Chapter 11, 11.2. And joining me this afternoon is Dr. Stu Taylor and Mary Richmond from Bechtel.

Let me start off with just kind of an

introduction on Slide 61, please. The AP1000 DCD was incorporated by reference for Turkey Point Units 6 and 7. The FSAR provided site-specific information in Chapter 11 for the Turkey Point units, as shown on PTN Supplement 11.2-1.

The areas discussed in the supplement are liquid waste management system and the liquid waste piping integrity, the deep well injection system, and the liquid effluent pathway analysis, which is comprised of two items. One is the groundwater modeling, the boulder zone vertical and horizontal modeling, and dose consequence.

Initially, I am going to discuss the first two, the management system -- liquid waste management system and pipe integrity, and the deep well injection, and then Mary and Stu will cover the last two topics.

Slide 62, please.

I'm going to be repeating some of the information that you have heard already relative to the wastewater flows, collection of that flow, and how we process it. So, and all I'm trying to do is establish a framework for discussion on the deep well -- deep injection system.

As you have heard before previously, the

Turkey Point Units 6 and 7 uses two sources of water for makeup to the cooling system. The primary is the reclaimed water from Miami-Dade South District Wastewater Treatment Plant. In the -- and I'll get to the actual flow numbers shortly.

The backup is the saltwater from the radial collector wells that withdraw water from beneath Biscayne Bay. The backup supply would only be used if the primary supply is not provided in sufficient quality and quantity to continue providing makeup to the cooling towers and other parts of the system necessary for requiring cooling.

The length of which -- the time that we can use the radial collective wells has been limited by the site certification, conditions of certification to 60 days per year I think as Stu brought up before. However, the liquid system -- liquid waste management system that we have has been designed to accommodate both water supplies, both reclaimed and radial collector well.

Slide 62, please. 63.

This diagram is to just represent how we collect water from the various source -- in-plant sources. The primary supply is from the main condenser blowdown. You get -- you have blowdown

from Unit 6 and blowdown from Unit 7. In addition, we have water sources, the wastewater retention basin from Units 6 and 7, the sanitary waste treatment system after treatment goes into the blowdown some, and reclaimed water treatment blowdown also goes into the sump.

From the sump, we have sump pumps which will then take the water and send it to the various wells. And you see on the bottom of the figure there are 12 injection wells shown.

In addition, we have an alternate dilution from the raw water system, which goes into the blowdown sump, and that alternate dilution is used in the event that the blowdown from the towers or the -- actually, the total amount of water in the blowdown sump is insufficient to get the dilution that we need prior to release. So we run separate lines that will allow us to add additional water from the reclaimed water treatment facility or the makeup water reservoir into the blowdown sump to give us the quantity of water we need.

You'll see on the red lines that come from the liquid rad waste system Units 6 and 7 -- that is the material that is being released from the monitored tanks in the plant, and they are injected

into the piping system on the blowdown sump pump discharge. So that's where the dilution takes place. The water coming from the blowdown sump and the liquid rad waste coming out of the monitored tanks is mixed at that point.

Just to leave that for a second, the process waste is discharged at blowdown sump for dilution. The minimum dilution factor is calculated to control the concentration that is in 10 CFR Part 20, Appendix B, effluent concentration limits, by specifying flow rates at the blowdown sump discharge.

The required minimum dilution is calculated and applied prior to release. The typical dilution flow rate to achieve compliance, as described in the DCD, is 6,000 GPM per unit for a rad waste tank release of 1,925 gallons per day or 1.5 GPM. But the actual -- the liquid rad waste effluent control program is implemented in accordance with the Turkey Point Units 6 and 7 offsite dose calculation manual. So we get the water coming in, we dilute it based on the calculations necessary to meet the concentration limits and the dose limits, and then we release it into the well system.

VICE CHAIR CORRADINI: So -- I'm sorry.

MEMBER SKILLMAN: No. Go ahead, Mike.

VICE CHAIR CORRADINI: Just to make sure I understand, so as you -- as the stuff leaves the green box and goes through the blue lines into the blue wells, what is the regulatory limit coming out of the green? Is it the 10 CFR 20 limit?

MR. JACOBS: No, the 10 CFR 20 limit would be after dilution. Where the red lines come into the blue, downstream, the point at which you need compliance is after it is diluted.

VICE CHAIR CORRADINI: After it is diluted but before injecting.

MR. JACOBS: Before injecting.

MEMBER RICCARDELLA: Is at the arrowhead. It's at the red arrowhead.

VICE CHAIR CORRADINI: Okay and then --

MR. JACOBS: That's the point of compliance, where the dilution, where the red waste water meets the liquid -- the low down water meets the liquid radwaste water. That is the compliance point.

MEMBER RICCARDELLA: The green isn't radioactive, correct?

MR. JACOBS: It is not. Before blowdown

from plant processes, it is not radioactive.

VICE CHAIR CORRADINI: I just wanted to make sure I understood. And then could just --

Maybe it was the slide 62 before but I missed it. I see the dilution rate. What was the flow rate of the radwaste that you are diluting? I missed it.

MR. JACOBS: For 6,000 GPM, which is a single unit based on the DCD tables, it is 6,000 GPM at 1.5 GPM from the monitor tanks.

VICE CHAIR CORRADINI: Okay, thank you.

MEMBER RAY: Dick, I think you were going to ask a question but let me just piggy back on what he said here.

So, at the blue point, you could, since you are meeting the dilution limits for the discharge, you could discharge it elsewhere, if you had the ability to do so.

MR. JACOBS: If we had a place to discharge it, yes.

MEMBER RAY: That's right. But it is going into the wells --

MR. JACOBS: As most plants do.

MEMBER RAY: As all plants do until now. So, that is why we are going real slowly here. But

the point that I want everybody to recognize is if you had a place to put it, other than the deep injection wells, you could do so at that point.

MR. JACOBS: Legally, yes.

MEMBER RAY: Legally, yes.

MR. JACOBS: Legally we could discharge that.

MEMBER RAY: I haven't done maximum exposed individual stuff and all that. But just from the standpoint of discharge limits --

MR. JACOBS: That flow could be released in other locations.

MEMBER RAY: Okay, thank you.

MEMBER RICCARDELLA: Let me just -- the numbers. So 6,000 GPM is coming out of the green sump per unit. And then what was the quantity in the red that was coming out?

MR. JACOBS: One and a half gallons per minute for each unit; one and a half from Unit 6, one and a half from Unit 7.

MEMBER RICCARDELLA: All right.

MR. JACOBS: But that number can vary, depending upon the concentrations in the monitor tanks and then calculate what the dilution rate is necessary.

MEMBER RICCARDELLA: So is the one and a half average or maximum?

MR. JACOBS: But based on the DCD, they use a 6,000 GPM and a one and a half GPM from the monitor tanks or 1,925 gallons per day is what the DCD talks about as a dilution flow rate.

MEMBER RICCARDELLA: Thank you.

MEMBER SKILLMAN: Paul, I listened to your words very carefully and I initially, since this might be a batch release, but the more I listen to you I concluded this may be a continuous release, as in 24 hours, one and a half GPM going into 6,000 GPM dilute. What is the deal?

MR. JACOBS: I believe it could be either way. It could be a batch in which, depending on the concentrations in the tank before release, the calculation of dilution numbers would vary and the amount of water in the blowdown sump may not be sufficient for the cooling towers and you may have to hold back some of the water until you can get the adequate amount of water to dilute to the required concentrations prior to release.

So, but it could be done on a one and a half gallon per minute basis or it could be done on a batch basis.

MEMBER SKILLMAN: Okay, let me ask the question that I believe is the 500 pound elephant in the room. A lot of us have operated plants. We have released, as we have needed to and we have obeyed 10 CFR 20, Appendix B, Table 2 for liquids. And many of us around the table really understand that very well from an operating perspective.

Since this is a subcommittee, many of us around the table are very hardened environmentalists, too. And we, I would say what kind of a nutty company would pump radioactive material into a zone where they cannot predict where the 30-year half-life cesium and strontium is going to show up and that utility doesn't know that that stuff won't hide out and wait. How would you answer that challenge? That is the 500 pound gorilla in the room.

MR. JACOBS: Well, I'm not the right person to answer that but --

MEMBER SKILLMAN: Maybe somebody could, because I, for one, would like to have that question ventilated.

MR. ORTHEN: We'll be getting into that shortly. We did conduct a thorough performance assessment over the 60-year life and out to 100

years for plant operations. The plant ceases operation in year 61 and we carried it out.

MEMBER RAY: You need to identify yourself. I can't --

MR. ORTHEN: I'm sorry. Rick Orthen, Florida Power and Light.

MEMBER SKILLMAN: Rick, please speak slowly so I can keep up with you, please.

MR. ORTHEN: Mary Richmond will be talking about the performance assessment we performed over basically a 100-year modeling horizon. And to answer that very question that you are posing, fate and transport of the material that is injected into the Boulder Zone.

MEMBER SKILLMAN: Thank you, I will be happy to wait.

MR. ORTHEN: Sure.

MEMBER SKILLMAN: Harold, thank you.

MEMBER RAY: Yes, thank you. Charlie?

MEMBER BROWN: I'm not an expert in any of this. I just listen. But was there a definitive basis for why the decision was to go this way versus the other way? It was basically a cost or ease of disposal or --

MR. JACOBS: That's on slide 65, if you

want to hold on a second.

MEMBER BROWN: If you have got a reason. In other words, why did we do this? That is --

MEMBER RAY: It is what was available to them Charlie but you will see that later.

MEMBER BROWN: Okay.

MR. JACOBS: Well, we can go forward and come back.

MEMBER BROWN: Can I finish my other? I have two questions and then I will defer, okay?

It is the 6,000 GPM out of the green area, which collects all the other waste. I mean that is all the various site waste. That is what I am reading in all the little boxes, non-contaminated waste.

MR. JACOBS: Yes.

MEMBER BROWN: Or at least radioactively contaminated.

And this other is the liquid radwaste is obviously collected and then you decide how you are going to release into this stream for deep well injection. You said it could be batch, which I imagine if you had a whole bunch and now you could just stuff it in at more than one and a half gallons per minute or do you just start the addition at one

and a half with the 6,000?

MR. JACOBS: No, you can release more than one and a half gallons per minute.

MEMBER BROWN: Okay, you have answered that.

MR. JACOBS: But again, it has to be calculated to make sure that the concentrations --

MEMBER BROWN: Is lower.

MR. JACOBS: -- and the dilution flows are correct so that you get the right release.

MEMBER BROWN: Got it. Okay. So, under either scenario, you have still have to meet these dilution scenarios to ensure at the end result, when it is going into the deep wells, you haven't exceeded some limits.

MR. JACOBS: Right.

MEMBER BROWN: Okay. All right, you have calibrated me. Thank you. I will wait until slide 65.

MEMBER RAY: Okay, please proceed.

MEMBER REMPE: Well, before you leave that slide, I have a small question. You are limited to 60 days of operation with the seawater dilution method and is there any concern about corrosion and any requirements on that with the

liners as you are diluting and you want to make sure that you don't put too much salt water down there?

MR. JACOBS: You are talking about the liners in the wells themselves?

MEMBER REMPE: Yes, before you deep injection. I mean there is clearly a radionuclide concentration limit you have to meet but is there a limit about how much salt water versus fresh water you put in?

MR. JACOBS: Into the well, there is no requirement to have either salt water or fresh water injected in the well. You can do either one.

MEMBER REMPE: But you have got to dilute with something. And what I am asking is are you concerned about the liners remaining intact?

MR. JACOBS: No because as I will show you in the construction drawings, the only thing that is affected by the injectate is the reinforced fiberglass piping.

MEMBER REMPE: Okay.

MR. JACOBS: And once you clear that water out, then you go back to your reclaimed water injection. It just washes all that residual salt out of the FRP.

Dave, Dave McNabb.

MR. MCNABB: David McNabb with McNabb Hydrogeological Consulting.

I just wanted to clear things up with regard to the liner on the injection well. There is, indeed, a liner, an FRP liner, fiberglass reinforced pipe liner, that protects the steel vinyl casing of the well. That is an 18-inch diameter fiberglass casing and the FRP is selected for its corrosion inhibiting.

MEMBER REMPE: Thank you.

MR. JACOBS: And while we are on the subject, we also have, between the FRP and the final casing, which is a 24-inch casing, there is a liquid we use. It is diluted corrosion inhibitor that is in that annulus area and it is pressurized to maintain some separation between the FRP, should it have a couple of drop leakage, into that annulus area to prevent any corrosion on the steel.

MEMBER RICCARDELLA: What is the thickness of the FRP?

MR. JACOBS: It is between the FRP and the 24-inch casing.

MEMBER RICCARDELLA: I understand. I asked what the thickness of the FRP is.

MR. JACOBS: Oh.

MEMBER RICCARDELLA: It's an 18-inch.

MR. JACOBS: It is an 18-inch OD. It is 16.6 IV.

MEMBER RICCARDELLA: So, it is about an inch thick.

MEMBER BALLINGER: I have what probably is a naive question but has anybody looked at the isotopic concentration of the radionuclides that are in the waste water to start with? In other words, we are dealing with radioactive waste that is plant-generated. But you are also taking municipal waste water from the City of Miami or wherever. And my question is has anybody looked at what the actual isotopic concentration is in that water?

MR. JACOBS: We have sampled -- I can't say for sure that we have all the isotopics but we have sampled that water continuously over the last six, seven, eight years.

MEMBER BALLINGER: So, it is clean.

MR. JACOBS: Well, I wouldn't go that far.

(Laughter.)

(Simultaneous speaking.)

MEMBER BALLINGER: We have got so many microcuries here and we have got 9,000 gallons or

12,000 gallons from the waste water system that is diluting this. Now, the isotopes are not likely to be the same, of course, at least I hope not. But nonetheless, is there the possibility that they are injecting more radioactivity from the waste water than you are from the plant?

MR. JACOBS: There was no known radioactive material.

MEMBER BALLINGER: All right, okay, because phosphorous is used in fertilizer.

MR. JACOBS: But they are all chemicals. And I think it was mentioned before that we have to remove, prior to use in our cooling tower makeup and that is why we established an on-site reclaimed water treatment facility prior to putting it in the makeup reservoir.

MEMBER BALLINGER: Okay. So -- okay, never mind.

MEMBER RAY: Let's try and keep on schedule.

MR. JACOBS: Okay, what are we on, slide 63? Okay, let's go to 64.

Here's where we get into the discussion of the system itself, the deep injection well -- the deep well injection system. The way this is

operated, the way it is going to be designed is we are going to have two sets of the piping associated with the radwaste discharge. The liquid radwaste from the radwaste building to the connection point on the blowdown sump pump discharge -- maybe it is better if we go back to the picture, so that you get a better perspective.

So, the radwaste from the radwaste building to the connection point on the blowdown sump pump discharge is going to be designed as a double wall pipe. It is going to be a process pipe within a guard pipe.

And to monitor for any potential leakage from the process pipe, we are going to have a collection pit where the pipe connects to the pump discharge. So, the red line is a dual wall pipe and the point at which around locations where the red line comes into the blue line, we are going to have a collection pit so that we can monitor for any leakage that may have occurred from the process pipe into the guard pipe.

MEMBER RICCARDELLA: Is that above ground or below ground?

MR. JACOBS: That is all going to be below ground. All the radwaste piping will be below

ground.

There will be a portion of -- and that is the second part of this. The second section is from the blowdown sump to the deep injection wells, the piping will be a single wall steel pipe partially buried and it will be above ground when it comes out of the blowdown sump, out of the pump discharge it will be above ground and then it will go below ground until it reaches the individual injection well locations. And then it will come above ground and into the head works of the deep injection wells.

MEMBER RAY: Yes, but at that point it would have been okay to have discharged to a stream or river or reservoir or lake.

MR. JACOBS: Yes.

MEMBER RAY: Okay, whatever.

MR. JACOBS: All plants do.

MEMBER RAY: We have recently gone through other plants that do discharge into surface waters. So, the guard pipe, until you get to that point, is a common way to ensure that you are not inadvertently undiluted radwaste.

MR. JACOBS: It is protecting against leakage.

MEMBER RICCARDELLA: And the underground pipe is cathodically protected, I assume.

MR. JACOBS: It will be cathodically protected.

MEMBER KIRCHNER: Will it be buried or will you just put it in a --

MR. JACOBS: We haven't made that decision yet whether it will be buried in the soil or it will be in a casing in a vault of some sort.

MEMBER KIRCHNER: A vault, yes.

MR. JACOBS: But we are going to design the system such that we are going to minimize leakage from the pumps into the wells by making sure that we design it to prevent inadvertent releases. It could be a series of curves, making sure only steel welded piping, no flanges, double isolation on instrumentation, you know those kind of engineering solutions that so we minimize the potential for leakage.

MR. MAHER: Just one thing, Paul. This is Bill Maher from Florida Power and Light. There was a discussion on cathodics. Just remember the entire side is about at least 20 feet or higher above grade in surrounding sites. So, it is not anticipated that this piping would go to the point

wherever you would be or in contact with groundwater, which we saw in the previous sections.

MEMBER RAY: Thank you.

MEMBER RICCARDELLA: But the fill could be corrosive.

MR. JACOBS: Yes, we will have adequate protection on the piping system.

I just wanted to add that even though we do have compliance at the point of dilution, we are still going to have a groundwater monitoring program. We are still going to be monitoring during normal operation and maintenance activities to make sure that there is no leakage from the pumps to the individual well sites.

Okay, so let's skip over and go to 64 for a second, please. Did I miss anything? No. Okay, 65.

What this slide is, it is showing that the background for how we got to the selection of the injection wells. Early on in the early phases of the project development, we did a comprehensive study to look at the alternatives for discharging blowdown from the circ water system. It identified nine alternatives, as you see on the slide and the screening that we used for determining which one was

the one we were going to use included statutory illegal restrictions prohibiting discharge, capacity of the water body or treatment system to treat or accommodate discharge and the technical feasibility of construction operation of the discharge alternative.

The one alternative that was feasible and middle of the criteria turned out to be the blowdown discharge to the Boulder Zone. And we have a detailed report on this but this is a high-level summary of how we got there.

MEMBER RAY: This isn't for anything that we are going to comment on and don't feel obliged to answer it. But I do wonder, when you talk about wastewater treatment plant not being feasible, of course the biggest plant in the country right now runs with a dry site, no injection, Palo Verde. Did you consider that specifically?

Again, you don't have to answer it because it is not our business but I am just curious as to whether or not you evaluated that option, since you have listed it there.

MR. JACOBS: We put it in a large build a lake or put it in something like that.

MEMBER RAY: No, you have a plant that

basically through ion exchange cleans up the liquid radwaste and turns it into a solid that you then ship offsite to the low level waste repository.

MR. JACOBS: I can't say for sure that that was considered.

MEMBER RAY: Okay. You don't need to. I just had to ask the question because I was involved in Palo Verde for a long time and I wanted to see if you had considered it. Certainly Bechtel is familiar with it.

MEMBER BLEY: Internationally, that is done in some, too. Maybe not nuclear plants but in processing facilities and reprocessing plants.

What do you do on the current?

MR. JACOBS: It is discharged into the cooling canal system. The discharge of the circ water pumps on Units 3 and 4.

MEMBER KIRCHNER: Paul, with this new design and all the advantages of AP1000 and the safety category, what about in the waste area? What is the expectation compared to your existing plants in terms of the amount of liquid waste that you are dealing with? Is it substantially less? Is it the same or is it a factor of ten less?

MR. JACOBS: I can't comment on the

comparative nature but maybe Rick Orthen can.

MR. ORTHEN: I can't add to that but I know that Westinghouse -- Rich Orthen. That is a question best for Westinghouse, the fuel failures and that sort of thing.

MEMBER RAY: Sorry, did you mean that to be on the record? Because we couldn't hear what you said.

MR. ORTHEN: Richard Orthen, Florida Power and Light.

MEMBER RAY: And what did you say about fuel failure?

MEMBER RAY: I am saying that is a question for Westinghouse. You are really talking about fuel performance, which drives a large portion of the liquid radwaste inventory, in addition to activation and corrosion products.

MEMBER RAY: Proceed.

MR. JACOBS: Slide 66, please.

VICE CHAIR CORRADINI: So, can I just make sure I -- the way you stated it is that some of these might be doable from an engineering standpoint but statutory or permitting restrictions excluded them. Is that what I am hearing?

MR. JACOBS: Yes. The permitting was if

not impossible, near impossible. You would never get a permit to do that.

VICE CHAIR CORRADINI: Okay.

MR. JACOBS: Biscayne Bay, Card Sound, Atlantic Ocean.

VICE CHAIR CORRADINI: Yes, that's fine.

MR. JACOBS: The Atlantic Ocean is 14 miles away. You would have to run it underneath Biscayne Bay. So, those kind of issues precluded the other alternatives from consideration.

VICE CHAIR CORRADINI: Thank you.

MEMBER SKILLMAN: But what I think is important is the question that Harold asked. There are other technologies available for radioactive waste and one of which is ion exchange and capture and burial in low level landfills. And so that is, again, the 500 pound gorilla in the room. And what I hear you saying is that was not an option you had considered but you chose, rather, for the deep well injection.

MR. JACOBS: At the time the study was done, I don't think that was considered.

MEMBER SKILLMAN: Okay, just so we are clear, I'm not suggesting that you should have done something differently. I'm just observing that is

where you are today.

MR. JACOBS: And my recollection of the study is that we didn't consider it but I would like to take the opportunity to go back and look at that report to make sure that it was or was not under consideration at the time.

MEMBER RAY: We're just asking a question here. That's all. Our job is to evaluate what you are proposing, not suggest you should propose something else. But you listed it so I had to ask. Okay?

MR. JACOBS: Next slide, please. Okay, this has been discussed. Again, the Lower Floridan Aquifer, referred to as the Boulder Zone, is the alternative for the blowdown. We are going to blow it down via the deep well injection system, referred to as the DIS to the Lower Floridan Aquifer.

It is approximately 3,000 feet below ground surface, a highly permeable zone containing saltwater and it is permitted by the DEP, the Florida Department of Environmental Protection for injection of sewage, industrial, and domestic waste in South Florida. And it has been used in Florida since 1943. So, it is well understood injection wells.

And I think this was brought up before. There is approximately 180 active wells. I think there are more now. I don't have the new number but this shows 180 active Class I injection wells that re in operation now.

MEMBER RAY: Well, but I don't know if this is the time yet or not but it is the "it" and what do we know about the "it" that is at issue here, at least for some of us. Is there any possibility that the wells that will be drilled for this application aren't communicating with the same large zone that all of these other wells have been using for 50 years or longer, actually?

MR. JACOBS: I think we are going to discuss that a little further on in the discussion.

MEMBER RAY: We'll discuss that further on? That is fine. Then please, defer to that because that is a real question. How sure are we that we know what we are injecting into from the standpoint of horizontal extent, not a depth profile, but to what extent could this be a limited body that we are injecting into more limited than we assume?

MR. JACOBS: Well we have two things that we are going to probably discuss. One is the

extent of the Boulder Zone and the other is how we actually determine when we are in the Boulder Zone while we are drilling the well, one of which I will discuss and I think Stu will discuss the other.

MEMBER RAY: Take your time and discuss it well. Thank you.

MEMBER RICCARDELLA: But just for my understanding, and this is so far afield from my area of expertise, but I mean we are talking potentially millions of gallons per day, right, that we are injecting into this zone?

MR. JACOBS: Yes, and I will get to that in a second. But in reclaimed water, we are talking about 18 mgd, 18 million gallons per day.

MEMBER RICCARDELLA: And a very, very small percentage of it is radioactive, I understand that but it is a tremendous amount of water over 40 years. I guess that is --

MR. JACOBS: Over 60 years, probably.

MEMBER RICCARDELLA: Sixty years.

MEMBER RAY: What is a Class I well?

MR. JACOBS: It is an injection well that -- Dave. No, because we actually drilled an exploratory well. It was a Class V well and we converted it to a Class I well. But there is a very

clear definition between a Class V and a Class I. I'm going to task Dave to weigh in.

MR. MCNABB: David McNabb with McNabb Hydrogeologic Consulting. There are various classifications for the UIC program. A Class I well is a well that is disposing of municipal or nonhazardous industrial waste that injects the low of the lower most USDW, USDW being an underground source of drinking water.

There are Class IIs. Someone was asking about the wells that dispose of co-produced water with the oil industry and then reinject it. Those are Class IIs.

Various other classifications. The well went in as a Class V exploratory well. We constructed it to Class I standards so that we could do the permitting to convert it to the Class I well. I hope I answered your question.

MR. JACOBS: Does that answer?

VICE CHAIR CORRADINI: So, just more information. So, currently in the same zone you are planning to discharge into your 180 Class I injection wells. Am I understanding that correctly?

MR. JACOBS: Well, the same -- the Boulder Zone, yes but not necessarily in the same

vicinity. These 180 wells are scattered around Florida.

VICE CHAIR CORRADINI: Okay.

MEMBER BALLINGER: So, Pete has mentioned that it is a lot of water and you have confirmed that it is a lot of water. But a lot of water with respect to what? What is the total injection rate from all the wells into the Boulder Zone compared to what you are planning to do at the plant?

MR. JACOBS: I don't have that number.

I mean the collective 180 injection wells, what is the total volume of water being injected? Is that the question?

MEMBER BALLINGER: Yes.

MR. JACOBS: I don't have the answer.

MEMBER BALLINGER: I mean is this injection source --

MR. JACOBS: Maybe Dave does.

MEMBER BALLINGER: -- going to be 80 percent of it? Is it going to be one percent of it, a tenth of a percent of it?

MR. MAHER: This is Bill Maher, Florida Power. We had talked about getting our reclaimed water from the South District of Miami-Dade County.

Currently, the South District of Miami-Dade County uses a Class I injection well to inject the reclaimed water that we would take. And their injections are somewhere slightly above 100 million gallons per day.

MEMBER BALLINGER: So we are talking --

MEMBER RICCARDELLA: So, you are basically just borrowing it, putting a little radioactive in it, and putting it in the same place it was going to go anyway.

(Simultaneous speaking.)

MEMBER RAY: Wait a minute. One at a time. We are creating a record here. So, let's --

MR. JACOBS: All I wanted to say is that the water that they currently are injecting, they are required to -- will be required for secondary use. So, us taking that up to 90 million gallons of water a day is a benefit to the county to allow them to meet the regulations and reuse that water. So, they can't do an outfall and giving it to us and using for cooling is an advantage to the county and, of course, or the power plant.

MR. MAHER: And this is Bill Maher again. We will go through the construction of the well. So, a lot of these questions on how do you

make sure it is going down into the Boulder Zone, what kind of testing, what kind of flow rates, how do you make sure that you are getting the flow rates that you are required are all part of the permitting process. And we will go through that in a later slide. So, hopefully, we will be able to answer all those questions.

MR. MCNABB: Excuse me. This is David McNabb with McNabb Hydrogeologic Consulting. I wanted to address the daily injected volume into the Boulder Zone.

Literally, hundreds of millions of gallons a day, every day are injected into the Boulder Zone in South Florida.

MEMBER BALLINGER: And the injection rate here again would be?

MR. JACOBS: Reclaimed water is 18 mgd.

MEMBER BALLINGER: So, 18 versus hundreds of millions.

MR. MCNABB: You are correct.

MEMBER BALLINGER: So, it is less than a percent.

MEMBER RAY: All of that assumes, of course, that we are communicating to the same zone.

Let's proceed. I'm watching the clock

here and we need to keep moving ahead.

MR. JACOBS: Okay, next slide, please. Slide 67.

The deep well injection system is going to -- and you have heard this again before -- there are going to be 12 Class I deep injection wells. They are going to be -- and the way we are setting them up is we are going to have ten primary and two backups. And we have six dual-zone monitoring wells, including all the piping, valves, pumps, and monitoring instrumentation.

The operation of the wells is identical, whether you are using reclaimed water or regular collected well water with the difference in the quantity of water that you are injecting. So, when you are using reclaimed water at four cycles of concentration in the towers, two wells with one backup will be used because you are only injecting 18 mgd. And each well is capable of handling approximately nine and a half million gallons per day at the specified velocity that we are using, less than ten feet per second in the well.

MEMBER RAY: Paul, you said 12. I just don't want to get the wrong thing in our letter. That says 11 there. Can you help me?

MR. JACOBS: That is in the saltwater, on the saltwater wells in the last bullet?

MEMBER RAY: Yes.

MR. JACOBS: Yes, because we have excess wells. We are going to use nine active and two backup when we are using regular collected well water. Because the blowdown amount is so much more significant than when you are using reclaimed, we need more wells. So, we will use nine wells active --

MEMBER RAY: I just heard you say 12 and I was trying to figure out where the 12 figured.

MR. JACOBS: The system is designed for 12 but when we use regular collected well water, we will only use nine with the backup.

MEMBER RAY: Okay.

VICE CHAIR CORRADINI: So, can I use an example? So, you have got 12 holes in the ground. You only need three normally but when you use saltwater you could use nine and you still have two backup plus one out of service.

MR. JACOBS: That's correct.

VICE CHAIR CORRADINI: Okay.

MEMBER RAY: It's the out of service one I couldn't figure out. Thank you.

MR. JACOBS: The injection rate is approximately 12,500 gallons normal or 18 mgd, with the liquid radwaste component of 3 gpm for the reclaimed water.

And for the regular collected well water, the amount we are going to be injecting is 58,000 gallons under normal conditions, which is 83.5 mgd, with the same radioactive material coming out of the radwaste system.

So, it operates the same way. It is just the way we align the various wells for injection.

Okay, moving on. This is a -- the figure is to just show where they are going to be located. We are going to have -- we have six pair of injection wells and they share a dual zone monitoring well. So, on the east/west line just north of the makeup reservoir, you will see three sets of injection wells with a dual zone monitoring well between the two. And likewise, on the north/south line, which is adjacent to the cooling canal return line, the cooling tower return, there is another set of three pair of injection wells and dual zone monitoring wells.

So, we spread out the injections around

the site. Okay? Can everybody see that?

MEMBER RAY: We're okay.

MR. JACOBS: Okay. So, this would be a cross-section of a typical, this is not the cross-section of the well that we dug on-site but it is very typical of what you will see.

The construction of the well is a series of basically of concentric casings that are placed at various depths. And each of the casings, and you can see it on the picture, each of the casings are cemented. Behind the casings are cemented. And the proposed depths of each casing are determined when we do the drilling in the geology of the site and FDPE requirements.

In this picture, the 64-inch, which are the outside is what we call a pit casing and that is just to stabilize the immediate surface for when you are putting the drilling equipment in.

The one below that, the 54-inch goes down to isolate to the area that isolates the Biscayne Aquifer. The second one, the 44-inch isolates the Hawthorne Zone. The 34-inch goes in below the lower level of the underground source of drinking water. And the 24-inch is the point of injection into the Boulder Zone. And again, those

depths vary from drilling to drilling.

The 34-inch and 24-inch casing elevations have to be approved by DEP. So, we give them the geological information based on the drilling. We submit all the information to them and we propose a depth and they approve that.

In this case, as you can see, the 24 and 34, because we isolate it from the USDW, the 34-inch and the 24-inch casing provide basically double protection against any leakage into the USDW, in addition to the casing and the concrete. So, it is well protected.

As I said before, inside the final 24-inch casing is the 18-inch FRP, with a 16.6-inch ID.

This drawing shows the bottom of this casing shows 2,900 feet. Below that is open hole. It is an open hole for another 500 or 600 feet below the bottom of the casing.

MEMBER RICCARDELLA: What is the pressure you have to pump at at the top?

MR. JACOBS: This one, for us, it will be about 60 pounds.

MEMBER RICCARDELLA: Oh, okay.

MR. JACOBS: It's not high pressure.

MEMBER RICCARDELLA: Okay, relatively

low pressure.

MEMBER SKILLMAN: Paul, what is the method of construction?

MEMBER RICCARDELLA: But it is not passive. So --

MR. JACOBS: I'm sorry?

MEMBER RICCARDELLA: You know the AP1000 is a passive design. This, I guess, can't be passive.

MR. JACOBS: It might be passive when we use saltwater, based on the density but when we are using fresh water.

MEMBER RICCARDELLA: Okay, thank you.

MEMBER SKILLMAN: Your sketch indicates that it is a seamless casing. Are these, what 20-foot sections that are welded as they are inserted? Is that how you do it?

MR. JACOBS: Yes, I think they are bigger than 20-foot. David, what were the --

MR. MCNABB: Forty some of these.

MR. JACOBS: I'm sorry?

MR. MCNABB: Forty.

MR. JACOBS: Forty-foot.

MEMBER SKILLMAN: Okay, fair enough. Thank you.

MR. JACOBS: But they are welded as we insert them into the hole.

MEMBER SKILLMAN: Thank you.

MR. JACOBS: Now similarly, which we don't have a picture of but I think on the next slide, yes, we have the similar dimensions for the dual zone monitoring well. It is a 34-inch, 24-inch, 16-inch, and a 6.6-inch diameter casings for the monitoring well, the dual zone monitoring well.

VICE CHAIR CORRADINI: So that means you take, you almost like take a sample.

MR. JACOBS: Yes, back up slide. There is a backup slide. We should put it in here. But there is a backup slide that shows the way in which we configure the dual zone monitoring well to show you how you get to take a sample from each elevation.

VICE CHAIR CORRADINI: And it is sitting between your pair.

MR. JACOBS: Yes.

VICE CHAIR CORRADINI: Okay.

MR. JACOBS: The two monitoring zones that you see on the bottom is the upper zone monitor is just above or at the base of the USDW and then the lower one monitors below the base of the USDW

above the confining area. So, you have those two monitoring points and we have connections up at the surface where you can actually monitor those fluids.

Would you like -- not necessary?

VICE CHAIR CORRADINI: You explained it to my satisfaction.

MR. JACOBS: Okay.

MEMBER BALLINGER: So the concrete is continuously cast? How is the concrete --

MR. JACOBS: It is poured. As we put in the casings, it is poured in there.

Okay, the next four slides talk about the testing that is done during the --

MR. MCNABB: Excuse me. David McNabb. I want to clarify the continuous pour on the cement. It is done in stages. We will pump a couple hundred feet worth of fill, let it cure for eight hours, twelve hours, come back and do another stage. We do keep on stepping up until we bring it up to surface.

MEMBER RAY: So there is no problem with the joint.

MR. MCNABB: None.

MEMBER RICCARDELLA: And your gaps between the casings that you are filling with concrete?

MR. JACOBS: Any gaps between the casings are filled with cement.

MEMBER RICCARDELLA: Between them, yes, that is what I mean. Yes, that is what you are filling with cement.

MEMBER SKILLMAN: One of the challenges that oil and gas individuals have dealt with is the sealing of the wells. Of course, this is a different technology. This is a well that is 5,000 feet under water and high pressure organic material below that well head. And so sealing that well is a technology that the big drillers at sea have been working on for decades. And it was what we witnessed for the Horizon event, the failure of the seal.

Is there a typical or is there a comparable challenge for this technology where the sealing at the various zones becomes an important feature for the future protection against leakage from zone to zone?

In other words, is there a bonding or a sealing between the aquifers to ensure that there isn't an inadvertent migration while the pumping is occurring?

MR. JACOBS: I don't see how we can have

any migration when the casings --

MEMBER SKILLMAN: Intact all the way down.

MR. JACOBS: -- are intact all the way down and they cover those local -- the aquifers that we want to protect, the casing system goes beneath those and then with cement behind them. And the FRP is the only place we are injecting fluid. So, there is no fluid anywhere else in the well.

MEMBER SKILLMAN: Okay, so for the injection well, the answer is hey, we don't really have to seal it. It goes down an open hole. We pump down the hole. It is welded the whole way up. And so we have got a clean --

MR. JACOBS: But the FRP, when it comes to the bottom of the 24-inch, there is a packer that is placed in there and that the FRP sits inside that packer.

And the headworks, which of course when the exploratory well that we produced, which we then converted -- well, we converted a Class V to a Class I under a construction permit and I will describe some of the operational testing that was to be done on it. We have just isolation valves on top of the well and it sat there for several years with no

difficulty at all.

MEMBER SKILLMAN: Okay, now, how about monitoring wells, where you are actually pulling samples to determine what is going on at the interfaces? Is there a technology that assures that you seal properly so that when you pull a sample you know for certain that you are sampling at the location where you intend to sample?

MR. JACOBS: Well, if I could show you the drawing. I think it would be Dick and Dave can talk to that but I believe that it is not possible to intermingle the two, the way the casings are arranged.

MEMBER SKILLMAN: Okay.

MR. MCNABB: David McNabb. And that is correct. Assuming that we have properly cemented the casing in place, it is not possible for the two to directly communicate. So you do know, as long as you are cemented properly, you do know that you are collecting from that discrete depth.

MEMBER SKILLMAN: How do you know you are cemented properly?

MR. MCNABB: That's done through proper cementing techniques. First of all, there is no aggregate. It is all a liquid cement, in liquid

form, very low viscosity to ensure that we are getting full flow around the outside of the casing. That's it.

It is just making sure that we are going with the right type of cement, making sure that we run our tremie line that delivers the cement to the place we want to put it. We run that tremie line to about a foot above the depth at which we want to start cementing. And as we fill up, we pull that tremie pipe up and keep on doing that in various stages until we are at land surface.

MEMBER RAY: Let me and maybe I should have said this early on. Let's keep in mind that our area of concern and obligation is with regard to radioactive liquid effluent.

Others have responsibility for other aspects of the performance of this system that we are talking about here. So, when we are concerned about how things function, we should keep in mind it is with regard to the radioactive material component and not other constituents of the material being injected because that is being looked at by others under different rules and assumptions than we use.

Okay? Thank you.

MEMBER RICCARDELLA: Is the FRP

continuous or are there growth wells in it?

MR. JACOBS: They are threaded sections.

MEMBER RICCARDELLA: Thirty-nine feet or something like that probably.

MEMBER RAY: Continue, please.

MR. JACOBS: The last four slides have to do with the testing that we performed during and at completion of construction. As you can see, we do a series of cement bonds, temperature logs, video surveys, pressure tests as we put in the casings.

We pressure test the annular space between the FRP and the final casing, to identify any leaks. And we do a video survey and temperature log of the FRP liner.

For the monitoring wells, we do similar tests. Next, please.

This is the operational testing and operation. Let me just quickly describe that.

When we dug the exploratory well, it was done under a construction permit, Class V construction permit. Then, we converted it to a Class I construction permit and we did a short-term injection test to verify A) that the well was operating properly; and B) that we were injecting into the Boulder Zone.

Then you go into a process of doing an operational test under the construction permit, which is a test not to exceed two years of injecting the quantity and type of fluid that you are going to use when the well is in operation.

When you finish that operational testing under the construction permit, you submit the results to the FDEP and then you ask for an operational permit. And that is when you can then inject continuously at the flow rates and the type of water that you had tested at into the well.

So, it is a fairly comprehensive testing process and a review process by the FDEP.

I just wanted to point out during the testing, the operational testing, we do annular space pressure. We look at the flow rates, pressure monitoring, and we do sampling, weekly sampling both for the injection well as well as the monitoring well. So, that is on the next slide, similar type of activities.

And the final slide is what we call the mechanical integrity test. And that is required to be performed every five years, as well as re-permitting the wells. Every five years, you have to submit a new permit request to the DEP for

continuation of operation.

So, the mechanical integrity test, we do the video survey of the injection tubing and the packer and the open hole interval. We do temperature logging for leak detection. We do the annual pressure test and we do a radioactive tracer survey so that we can make a determination of the integrity at the seal of the base of the final casing.

We do an interpretation of the five-year monitoring and operating data that we have been collecting and we submit to the DEP for their review.

MEMBER RAY: Any further questions?

MEMBER RICCARDELLA: DEP, Department of Environmental Protection?

MR. JACOBS: Yes, FDEP, Florida Department of Environmental Protection.

MEMBER KIRCHNER: I would like to ask perhaps some of your experts that are with you, Paul, or the NRC's staff what is -- I think one of the issues Harold was getting at earlier is these seem like large volumes of water to us. How laterally will this potentially contaminated cloud of injected water spread; over what time frames?

What is the permeability and what is the experience with the other direction injection wells, in terms of any operational problems or issues where injected municipal waste finds its way to the surface? Or you mentioned fresh water aquifers. Are there any fresh water aquifers in this region of Florida?

MR. JACOBS: Not within the direct vicinity of the site.

MEMBER KIRCHNER: Like how far?

MR. JACOBS: I don't know where the drinking water aquifer starts.

MEMBER KIRCHNER: But not underneath you.

MR. JACOBS: Not underneath us, no.

MEMBER KIRCHNER: There are no directly under you. Are we talking tens of miles, twenty?

MR. JACOBS: The Floridan Aquifer, which is from ground to about minus 1,100 feet, there is some brackish water that could be processed for drinking water. But as it comes out of the ground, it is probably not drinkable.

But if I can defer some of those other issues that you brought up, not necessarily the one regarding any failures that were found in other wells. We can handle that separately. But at least

the Boulder Zone discussion, the movement of fluid, those kind of things are going to be discussed.

MEMBER KIRCHNER: What is the time frame we are looking at for this much water to actually disperse from directly under your site and how far does it migrate?

MR. JACOBS: Between Stu and Mary, I think we can cover those topics.

MEMBER KIRCHNER: Okay.

MR. JACOBS: And at that point, if we have more questions, we will deal with it.

MEMBER KIRCHNER: In the context of the half-life of the radionuclides you are injecting what is --

MR. JACOBS: We did that analysis. So, Mary can cover that.

MEMBER KIRCHNER: -- the underground picture?

MEMBER SKILLMAN: Let me ask this. I had asked a question about whether or not there needed to be some form of sealing, integrity seal. And I understood the answer to be no, the bore ends in an open hole that goes down into the Boulder Zone. But this slide, the third or fourth bullet indicates a tracer survey to test integrity.

Back to Harold's point. I'm asking my questions because of the potential that the radionuclides that we are presuming stay in the Boulder Zone don't stay there, that they go someplace else.

So, talk a little bit about this seal.

MR. JACOBS: The seal at the bottom of the casing?

MEMBER SKILLMAN: Uh-huh.

MR. JACOBS: Well, let's talk about the radioactive tracer, first. So, if you go back to the picture of the cross-section of the well, what we do is we inject radioactive iodine and we look for any kind of impact on this casing cementing to make sure because the iodine that comes in here will right back up. And we put monitors in there, so we know if there is some kind of a defect in the cement.

CHAIRMAN STETKAR: Paul, it is better if you -- we have this technology called a mouse. So, if you point -- see? That way, you keep close to your microphone and we can pick you up orally.

MR. JACOBS: All I was saying is that the lower section, when we do the radioactive tracer survey, we inject the iodine into the bottom of the

well through the FRP and then we look, and I don't remember the exact elevations but we insert monitors inside the FRP to look for any kind of radioactive material that comes up. So, that would only deal with the lower section.

MEMBER SKILLMAN: Yes, that's fair enough.

MR. JACOBS: Okay. Now, if you are losing pressure in the annular space because between the FRP and the 24-inch casing, that is filled with water, BARACOR and water mixture, if you are losing water, we monitor the surface pressure. We have a gauge at the surface. We monitor that pressure. And if there is a leak at the bottom, you will notice that the pressure goes down. It will go down. Because the pressure, the hydrological pressure doesn't increase the pressure. It decreases the pressure slightly.

So, we know if there is a problem with the FRP.

MEMBER SKILLMAN: So, is the once each five-year certification from Florida FDEP dependent upon successful passing of that sealing test?

MR. JACOBS: We have to provide all the data. We have to successfully provide all the data

and all the testing information for them to approve the next permit period.

MEMBER SKILLMAN: And does that include confirming the seal?

MR. JACOBS: Specifically, I don't know how we would do that, Dave. Maybe you can address that. How you would know whether the seal is intact, other than the reduction in pressure.

MR. MCNABB: David McNabb. Are we talking about the seal at the base of the -- the cement seal on the outside of the final casing or are we talking about the seal of the annulus?

MEMBER SKILLMAN: I believe it is the seal at the bottom of the casing.

MR. MCNABB: I think that -- that is what I think. That is, indeed, tested with the radioactive tracer survey. And the way that works is we lower a tool down to about five feet inside the base of the casing and we release a couple of millicuries, one or two millicuries of iodine-131.

At this time, the well is flowing at a rate of about 25 gpm. The thought being that that low rate is going to allow that iodine time to sort of linger around the base of the casing. And if there is any upward fluid movement at the base of

the casing, that iodine is going to go get drawn up.

We then gamma ray log that area to look for any evidence of iodine on the back side of that casing, which would suggest a compromise in that seal.

Those results are written up in the mechanical integrity testing report, along with some of the other tests, along with all the other tests that are involved with MIT and submit it to DEP for review and approval.

It is unlikely that we would ever obtain an operating permit if that test or if that report was denied or unacceptable. If we are lacking a seal, they are going to make us go repair that seal before we ever get an operating permit.

MEMBER SKILLMAN: Okay, thank you.

MR. MCNABB: You're welcome.

MEMBER SKILLMAN: Thank you.

MEMBER RAY: Thank you. And once again, the water at that point that is being injected is water that could be released into another body of water, if one were available.

MR. JACOBS: Correct.

MEMBER RAY: We are not talking about the concentrations that exist in the plant. We are

talking about fully diluted --

MR. JACOBS: Fully compliant, diluted water, yes.

MEMBER RAY: Okay. All right, I just want to keep us focused here on what the concentrations are.

All right, what is next? Mary's next.

MEMBER KIRCHNER: Harold, may I go back to my question? Because it bears on what you were asking earlier.

What is the lateral dispersion? What is the time frame and extent? And how is that compared to the radionuclide half-lives?

MEMBER RAY: Well, perhaps Mary will inform us now.

MEMBER KIRCHNER: Okay.

MS. RICHMOND: Okay, can you hear me now? Yes.

All right, we will be getting into a lot of the groundwater monitoring. I will just do a little introduction and then I will be giving it over to Dr. Taylor and he will be discussing in detail the radial extent of the discharge.

Mr. Jacobs discussed the design at Turkey Point 6 and 7's Liquid Waste Management

System. As Mr. Jacobs discussed, the discharge of radioactive effluents at the plant blowdown sump discharge line, which includes the minimum required dilution to achieve compliance with 10 CFR 20 Appendix B, Effluent Limits, does not differ from that of other applicants. It is only in the release point to the environment that that is different.

Traditionally, the discharge method, as we have discussed several times now that Mr. Ray has talked about is usually to surface waters.

MEMBER BROWN: Mary, is there a Ferrier mechanism in terms of when you are pumping stuff in where you could end up with a dilution that is not satisfactory for going as it is injected in? Is there some way that you could, whatever the circumstances are, that would allow higher than the minimum necessary dilution?

MEMBER RAY: It would be true at any plant, that that is the case.

MEMBER BROWN: I understand but this is radwaste and that is why I just --

MEMBER RAY: No, it would be true of radwaste at any plant that you could exceed your authorized discharge limits if there was some failure, such as a valve left open when the pump was

turned off.

MEMBER BROWN: But is it detected?

MEMBER RAY: The means to detect it, that is the question I tried to ask.

MEMBER BROWN: That is what I was asking.

MEMBER RAY: Okay.

MR. JACOBS: Flow monitoring device.

MEMBER BROWN: I understand the flow part.

MEMBER RAY: Use your microphone, please.

MR. JACOBS: We are going to have flow monitoring devices on both the effluent from the radwaste system, as well as from the blowdown sump.

So, once we do the calculation and determine how much for what we are going to release what the required dilution flow is, we can monitor that to make sure that we are getting the adequate flow.

MEMBER BROWN: So, it is a volumetric mixing that you are using, then, to ensure -- from one system to the other to ensure that when it goes into that last pipe, before it goes into the deep well, that you have the proper dilution.

MR. JACOBS: Yes, and it is unlikely for us to have that situation because we have to get rid of that water because it is the blowdown from the towers.

So, we have to move it out of the blowdown sump. So, it is not likely we will have a pump shut off and we are just releasing radioactive material into an empty

MEMBER BROWN: Is the volumetric release differ from the red waste collection area stinkered such that it can't be more than a certain amount of curries per whatever before it, you know --

MR. JACOBS: I don't know that is through the flow rate but --

MEMBER BROWN: I'm just -- I'm looking --

MR. JACOBS: -- based on the --

MEMBER BROWN: -- for something, for that for dilution factor to be and I didn't hear anything in the previous discussions. So, that's why I'm --

MR. JACOBS: Well, based on the --

MEMBER BROWN: Can we monitor it?

MR. JACOBS: Yes.

MEMBER BROWN: Is it monitored? Is it

tested? Can you detect it? That's all.

MR. JACOBS: I think you can detect it. You -- the constituents in the tank are monitored to make sure that whatever they -- it may not even be the full list that you see.

MEMBER RAY: I think if I can interject here, we probably should have answered your question, simply, Charlie, when we -- you're basically asking, is it possible to discharge effluent without the necessary dilution?

MEMBER BROWN: Yes.

MEMBER RAY: Yes, of course it is at any plant you can do that.

MEMBER BROWN: Okay.

MEMBER RAY: And, so, you're asking then, well, how do you detect that? Let's answer that question on a list of questions to be answered.

MEMBER BROWN: That's fine.

MEMBER RAY: But --

MEMBER BROWN: That's acceptable.

MEMBER RAY: -- it can certainly happen that the system is operated improperly or it fails to be recognized that you've got liquid effluent going out with no mixing taking place. That could happen.

But, I'll ask you guys, tomorrow is fine, to tell us, do you have radiation monitors on the discharge line that would detect that or whatever?

MR. JACOBS: Okay.

MEMBER RAY: Okay?

MR. JACOBS: We'll respond to that.

MEMBER RAY: Yes, that's fundamentally looking for how can you detect it if something happens? That's all.

Dennis, did you want to say something?

Mary, go.

MS. RICHMOND: All right.

So, tradition disposal methods for liquid radioactive effluent are to the surface waters, that's the point, where the radioactive effluent is diluted and disbursed in receiving waters and immediately available for a member of the public exposure.

Turkey Point Unit 6 and 7 deep well injection system is nontraditional discharge method in this area.

Due to the depth, about 3,000 feet below ground and the presence of confining units, it's not expected, under normal operating conditions, that

radioactivity injected into the boulder zone would reach either an underground surface drinking water or a surface environment.

Because radiological assessment methods used quantify radiologic impacts and demonstrate compliance with NRC regulations are for effluence discharge to surface water, Turkey Point had to perform a different analysis to ensure that the compliance for 10 CFR 50 Appendix I limits.

MEMBER RAY: Well, could I say that, actually, you started out, I believe in 10 CFR 20 2002.

MS. RICHMOND: Right. And --

MEMBER RAY: So, if you could just begin with that for the record and what that then leads you to, what you just said?

MS. RICHMOND: Okay.

So, 10 CFR 20 2002 provides a process for obtaining approval for proposed disposal procedures. And, the approval of these procedures to dispose of licensed materials needs to include a description of the waste containing material, analysis and evaluation of the pertinent environmental nature of the environment that you're releasing to, which will be discussed in great

detail.

Any nature and location of other potentially affected licensed and unlicensed facilities and analyses and procedures to ensure that the doses are maintained ALARA with in dose limits of 10 CFR 20.

And the 10 CFR 50 Appendix I is considered and determine whatever the releases to the matrix are.

MEMBER RAY: Okay, now she just read what --

MS. RICHMOND: Right.

MEMBER RAY: -- 10 CFR 20 2002 says --

MS. RICHMOND: Right.

MEMBER RAY: -- verbatim. So, that's what we're going to do now. So, proceed.

MS. RICHMOND: Right.

MEMBER REMPE: Before you do, you're doing this, just to make sure I understand, you assume one plant operates for 60 years or both -- I just -- both units operate for 60 years. So, you're assuming the initial license plus the life extension.

Do you consider the other operating units at the plant?

MS. RICHMOND: No, they won't be discharged into the boulder zone.

MEMBER REMPE: But, you're looking at the maximum exposed individual who might be not just eating shrimp or whatever, no, I know that.

But, right, I mean, do you -- you don't have to consider the other two units, but you do have to consider both of these units in this process? I'm not familiar with the process, so the -- or what did you do in your analysis and I want to understand what the staff did in their analysis to check you and to see if we're comparing apples to apples.

MS. RICHMOND: Okay.

We took the dose for the operating Units 6 and 7 and we did not look at -- Ken, correct me if I'm wrong -- add to the MEI doses from Units 3 and 4.

MR. JHA: Is this on?

MS. RICHMOND: Yes, sir.

MR. JHA: Ken Jha, Bechtel.

The location for the Units 3 and 4, the maximally exposed individual location is different for Units 3 and 4 than it is for 6 and 7. Therefore, we would not be adding the two doses if -

- that's why we're not considering them together.

MEMBER REMPE: But, you did have to consider both of these units because that individual is there and so whatever other --

MR. JHA: Yes, because the same location for these two units.

MEMBER REMPE: Okay, thank you.

MEMBER RAY: They actually added one year to the 60 years to account for the second unit shutting down a year after the first one.

MEMBER REMPE: I saw that, too. But, I just was curious why you just -- I mean, yes, they're located at different locations, but is it totally irrelevant the other units are operating to this maximum exposed individual?

MEMBER RAY: Well, that's a fair question, but in any event, the releases are certainly going to different places to start with. The question is, do they get back somehow to the same person? That's a fair question.

MEMBER REMPE: Yes, that's what I'm just kind of curious about when I reading this description because I'm familiar with how the process is done and what is and isn't allowed, what's in and not in.

MS. RICHMOND: Okay.

And, then your answer a question depends on, we'll get into who our maximally exposed individual is which, as Ken was saying, it's going to be very different from in the three and four individual.

So, you want us to proceed?

So, to determine the maximally exposed individual dose for compliance with 10 CFR 50 Appendix I design objectives, a performance assessment was performed.

And, this was conducted to assess the environmental fate and transport of liquid effluent discharged via the deep well injecting system to the boulder zone.

The performance assessment coupled numerical groundwater modeling techniques with a liquid path by effluent analysis. The liquid path by effluent analysis was designed to identify the appropriate number of the public receptors and ultimately determine the maximally exposed individual for MEI.

Given that the design of the Turkey Point 6 and 7 deep well injecting system and determine exposures scenarios, we had to, I mean, we

just really come up with some extraordinary events and assumptions to try to get an exposure when you're placing water 3,000 feet down below. So, we'll go into how we were able to determine this.

Next slide 77, please?

This is the process that we went through engaged in the formulating the liquid pathway analysis.

Initially, what we had to do is come up with some considerations in order to understand fully where some points of the exposure could be.

So, we wanted to determine some attributes of the deep well injection system to formulate the basis.

Once these bases were formulated, we developed some scenarios to determine some exposure methods. Then, we screened these scenarios for feasibility and retained some scenarios based on the credibility and ultimately, we chose the bounding MEI dose.

Slide 78, please?

MEMBER RAY: Did any of the scenarios include hold up for a period of time and then subsequent release from the boulder zone?

MS. RICHMOND: No. Hold up as in it's

not -- you're not allowing the flow in the boulder zone?

MEMBER RAY: Yes, it may be from what you've said so far that this is not a credible scenario. So, that that's -- I just would like to get it off the table if it isn't.

But, we've asked about the question on how do you know about the extent of lateral diffusion and so on. And, the one thing that's different than putting this water -- putting this discharge into a river, lake, reservoir or ocean directly is the potential, not for it to get away and get further diluted, but for it to be held and then has access to the maximum exposed individual through a well that's drilled a 100 years from now into a zone where this stuff has been trapped for 60 years, something like that.

And, that may be so incredible that it just doesn't bear consideration, but I'd like to be clear that that wasn't one of the scenarios that you discussed here.

MS. RICHMOND: It's not one of the scenarios we discussed, but Dr. Taylor is going to be discussing how we determined the radial extent of the monitor and he'll be going into a little bit of

the absorption radionuclides done about that.

MEMBER RAY: Okay. Well, when you do that, and we're probably going to take a break before Dr. Taylor talks, but, you know, some of us will want to be assured that, in fact, this stuff is going to migrate. Not that it's going to be held here and not ever go anywhere.

That's the, you know, the first concern is that it not get leakage like some of the questions that we've asked to other aquifers.

But, inevitably, that involves further dilution of something that was already diluted sufficiently.

So, the real other side of the coin, so to speak, the thing that's novel is that we're putting it in a place where we don't know what the further dilution is going to be, unlike surface waters.

MS. RICHMOND: Okay.

MEMBER RAY: And, what is the worst case when it comes to that? And, I ask that now because you are in to the scenario --

MS. RICHMOND: Right.

MEMBER RAY: -- description and that's why I ask it once again.

MS. RICHMOND: Right.

MEMBER RAY: Okay?

MEMBER POWERS: But, if it were held up, it's still permitted water, right?

MEMBER RAY: Yes, I don't know how that scenario works, Dana. I just wanted to know if they considered it. It may turn out to be no worse than any other scenario, I don't know.

But, the thing that's unique and different here is --

MEMBER POWERS: Well, I understand --

MEMBER RAY: -- that that might not be a possibility.

MEMBER POWERS: -- I mean, I understand your argument here and why you raised the issue. But, it seems to me that suppose it was there -- suppose there was a waterproof cavity in the particular zone where they just happen to go and it just filled up with water and it sat there for a 160 years and then the infamous farmer that seems bound and determined to kill himself drills into it, it's permitted water.

MEMBER RAY: Yes, that would be my first reaction. I don't disagree with you. But, I just wanted to know if it was considered as a possibility

to establish that.

Because I could say things that would show you how ignorant I am about how that might not be that benign. But, in any event, I'm taking time here that I shouldn't take. I just want to make sure you were prepared to discuss that.

MS. RICHMOND: Right.

MEMBER RAY: And, ask you to proceed.

MEMBER RICCARDELLA: Could you describe some of the scenarios? Are you planning to describe --

MS. RICHMOND: We are going to --

MEMBER RICCARDELLA: Oh, okay.

MS. RICHMOND: -- some of the scenarios.

CHAIRMAN STETKAR: Mary, and maybe you'll that when you get to the scenarios.

MS. RICHMOND: Right.

CHAIRMAN STETKAR: But, we've used the term several times and we see it here. What's the discriminator between something that's credible and not credible for the purpose of your evaluation?

MS. RICHMOND: For the purpose of this evaluation, we were looking at credible scenarios, things that could potentially happen based upon some of these attributes and bases that we described

early on like looking at the results of the groundwater modeling, hydrogeology considerations, well failure rates, where that member of the public, their access, would the potentially have access at the point that we're at the scenario. I mean, are they -- is member of the public going to be able to get on site to where the wells are and be exposed?

So, there was a lot of considerations that went into the scenarios.

CHAIRMAN STETKAR: I understand there are a lot of considerations, that's not what I asked.

What's the discriminator between what is credible and what is not credible?

MS. RICHMOND: If there was --

CHAIRMAN STETKAR: Is it -- did you, in particular, did you use a numerical discriminator or did you just say, well, that doesn't sound very credible to me, so I'll discount it?

MS. RICHMOND: It wasn't a numerical --

CHAIRMAN STETKAR: Okay.

MS. RICHMOND: -- discriminator.

CHAIRMAN STETKAR: Thank you.

MR. MAHER: Yes, this is Bill Maher, Florida Power & Light.

If I could, one of the areas that Mary's going to go into as far as a scenario that we ended up with, while we still call it not credible would be drilling or a well down 3,000 feet in order to get salt water.

And, if you go -- the actual scenario we go to, one of the attributes is actually drilling a salt water production well down 3,000 feet.

So, if you look at where we are at, drilling a six and a half million dollar well to get salt water when you're about three miles from the ocean seems a little bit off.

So, while it's not deterministic from a number standpoint, that's some of the thought process that we went into.

CHAIRMAN STETKAR: Okay. Maybe we'll learn a little bit more. Thanks.

MS. RICHMOND: Right.

Okay. So, next slide 78, please?

As described, there are several analyses and considerations that were necessary for us to formulate the bases for our scenario development.

That is, in order to postulate exposure scenarios and come up with the ultimate dose to the MEI, the fate and transport of the liquid radio

effluent had to be fully understood.

Because a liquid effluence is released via the deep well injections, understanding the groundwater transport of the radioactive played a significant role in us coming up with our scenarios.

And, like I previously said, we also looked at hydrogeology, well failure statistics, land use, who was going to be using what around to come up with this.

And, because the groundwater modeling was so significant in this regard, Dr. Stu Taylor's going to lead the discussion on the groundwater modeling efforts that were undertaken by FP&L.

CHAIRMAN STETKAR: By the way, just for the record, in the FSAR, credible is such a scenario may be expected to occur during the operational lifetime of the plant or beyond.

Noncredible, such a scenario is not likely to occur during the operational lifetime of the plant or beyond.

However, it's included to provide a bounding dose.

I mean, that's what you used. I was trying to find out what likely means.

MS. RICHMOND: Right.

MEMBER SKILLMAN: I'd like to ask a quick question before we go into Dr. Taylor's presentation. This is to Paul.

The 180 wells that you've described, this is going to be 180 plus wells, right, 192? Of the existing 180, are there any municipalities or entities putting radioactivity into their well or will these be, at least at this point in time, the only 12 into which isotopes are being pumped?

MR. JACOBS: David McNabb will answer that question.

MEMBER SKILLMAN: Thank you.

MR. MCNABB: David McNabb.

Yes, indeed. A fair amount of the injection well systems, municipal injection well systems, are associated with reverse osmosis concentrate disposal.

And, there is some low level gross alpha radium 226, 228 that gets concentrated in that process and that gets injected.

MEMBER SKILLMAN: Thank you.

MR. MCNABB: You're welcome.

MEMBER RAY: Okay, before we go to Dr. Taylor, we are going to take out afternoon break here. It's time for it. We will come back at 20

minutes, no, yes, 20 minutes to 4:00.

(Whereupon, the above-entitled matter went off the record at 3:21 p.m. and resumed at 3:39 p.m.)

MEMBER RAY: We'll resume with Dr. Taylor.

Right now, we're I don't know how far behind we are, but we'll keep pushing on here. We won't go past 6:00, hopefully, we'll get today's agenda done before then.

MR. TAYLOR: Thank you. Thank you, Chairman.

Again, my name's Stewart Taylor. I'm going to talk a bit about the groundwater modeling that Mary Richmond described earlier.

But, before I talk about the transport modeling that was conducted, I'd like to revisit the boulder zone and just give you a little bit more background information.

First of all, there were some questions about, you know, how extensive -- aridly extensive the boulder zone is. So, this particular illustration is from a publication by the U.S. Geological Survey.

So, this -- the area shown in orange is

the sort of known extent of the boulder zone. And, you can see that it covers, you know, all of South Florida. And, they just mapped, you know, what's below the land surface, presumably it extends offshore under the ocean in some places.

It's about 3,000 feet below the surface at the site. It's reported to be about 500 feet thick.

The boulder zone is highly transmissive and, by transmissive, I mean by that, it's able to conduct very water -- or conduct water very easily so it doesn't take much pressure differential or head gradient to cause water to move very readily.

So, this value, I give a value here of 250,000 feet squared per day. You may not have the context for that, but in terms of, you know, transmissive, these report in literature, this is sort of on the very high end that's been observed.

MEMBER RAY: Tell us if you can about the, apparently, a couple little spots there don't participate in the zone. They're isolated within the zone showing there look like -- do you know anything about how that's established?

MR. TAYLOR: You're talking about this area?

MEMBER RAY: And, basically, what I'm looking for is this -- how much is this assumption, how much of it is data that are -- that have been -- they're specific to the whole thing?

MR. TAYLOR: Yes, and I understand your question and, unfortunately, I couldn't tell you, you know, why these little islands appear here.

I can tell you, I mention it here and you've heard it before, that there's a lot of Class 1 injection wells have been permitted. It's not shown on this particular slide, but there's a figure in the FSAR that shows the distribution of these injection wells. And, they do cover a good part of South Florida.

So, in my mind, that's very good evidence that this hydrogeologic theme that is fairly extensive.

MEMBER RAY: Okay, good. That's -- so, Paul, have somebody give us the FSAR reference for those wells because, I think, having the confidence that we have hard data on the boulder zone is quite important.

MEMBER RICCARDELLA: Could you help with that -- the units of that transmissive -- transmissivity? I would have thought it be --

MR. TAYLOR: Sure. Those are feet squared per day. So, transmissivity is the produce of hydraulic conductivity and unit thickness. So, it's --

MEMBER RICCARDELLA: Oh, it's pre in thickness?

MR. TAYLOR: Yes, so the 500 feet time the hydraulic conductivity would give you the 250,000 feet squared per day.

MEMBER RICCARDELLA: Oh.

MR. TAYLOR: Yes, and I've talked about this being used extensively in others since 1943.

And, I guess the other question that came up was, you know, this concept or thought that you could be pumping water in this zone and it's like a closed system and, you know, at some point, you pump, pump, pump and then you'd hit an incremental boundary and it would propagate no further.

But, my understanding of the many injection wells is that they have not encountered this. I mean, if you were to pump into a formation and, over time, if you did hit one of those incremental boundaries, you would see a pressure build up at the well head.

And, at least, my understanding of the operational knowledge of, you know, these, you know, close to 200 injection wells is, that's not occurring.

So, I think that's some evidence that sort of corroborates that this unit is aridly extensive.

CHAIRMAN STETKAR: Stewart, you said how long is the longest lived injection well of these 200 wells?

MR. TAYLOR: I believe since 1943.

CHAIRMAN STETKAR: Okay, so you've got about 70 years or some odd years.

MEMBER RICCARDELLA: I think somebody asked earlier, just in kind of a general sense, over 60 years, how big would this cloud become?

MR. TAYLOR: I have -- I'm going to talk about the transport model in a little more detail and I have a graphic that addresses that question.

MEMBER RICCARDELLA: Thank you.

MEMBER KIRCHNER: Just one more time on the injection wells, what's it -- these are for municipal waste water primarily or produced water?

MR. TAYLOR: Municipal and industrial and produced water.

MEMBER KIRCHNER: And, they're typically, I think, from staying other areas like 100 million gallons a day? I mean, they're sizable compared to your discharge?

MR. TAYLOR: Yes, and --

MR. JACOBS: I think what Dave said was that the combination of the wells are pumping hundreds of millions of gallons a day. That's what a district plant by itself is pumping 110 million gallons a day.

MR. MCNABB: David McNabb.

Your typical injections wells disposing of typically a maximum of about 18.6, that's a 24 inch diameter municipal well. That would be the maximum permitted rate, 18.6 MGD.

Also, I wanted to just a little minor correction, the oldest operating injection well, we started injecting into the boulder zone in 1943.

The oldest system, to the best of my knowledge, that is still in operation began in the 1970s and is still in operation.

MR. TAYLOR: All right, slide 80, please?

So, let me talk in a little more detail about the radial transport modeling.

So, the objective of the modeling was to determine radionuclides in the boulder zone in space and time and look and see how large this bubble is at the end of 61 years.

These concentrations that come out of what we're calling the radial transport model are then provided. The peak concentrations are then provided to Mary and she'll talk about what the associated doses are for those concentrations.

So, for -- to do this modeling, we used a variable density groundwater flow and transport code.

We used something called SEAWAT. SEAWAT is a code developed by the U.S. Geological Survey that we needed a variable density code because the injectate density differs from the water in the boulder zone, which has a density of sea water.

So, when we're running off the reclaimed waste water, even though it's cycled up four times, it's still sort of falls into the fresh category, so it's lighter than the water in the boulder zone. It would have a total dissolve salts concentration of about 2.7 kilograms per cubic meter.

So, when it is injected in the boulder zone, it would tend to float to the top of the

boulder zone. And, then, conversely, if we're operating the radial collector well system in cycling up sea water when in F concentration, it would have density greater than the receiving water in the boulder zone. It would have a density of about 57,000 kilograms per cubic meter.

So, when that cycled salt water is injected, it would tend to sink to the bottom of the boulder zone.

So, to capture all these processes, we needed a numerical code that accounted for these density variations in the different fluids.

MEMBER CHU: Do you -- I mean, it travels so there must be a natural gradient, right? Do you actually have data on that?

MR. TAYLOR: There are reports that have characterized that gradient. There have been studies by others done. They've looked at different types of data.

One type of data they looked is naturally occurring isotopes like carbon-14. They can compare the carbon-14 in the current sea water and then water that's sampled out of the boulder zone and then infer a depletion of carbon-14. And, this suggests a gradient toward inland -- towards

the center of the Floridan Plateau.

There's also been some corroborating data where people have measured pet differences transmissivities that correlate fairly well with those natural isotope studies.

And, that gradient is very small.

MEMBER CHU: But, with all the pumping, wouldn't you increase the gradient somehow?

MR. TAYLOR: Well, there -- when pumping occurs, so there's two mechanisms that are operating simultaneously.

So, there's a very small inward gradient and then there's a gradient that's a forced gradient that's induced by pumping.

So, the gradient induced by pumping acts to regulate in all directions. And, the magnitude of that forced gradient from the injection is much, much greater than the natural gradient.

So, as you inject the water, you can think of this bubble or cylinder expanding over time, you know, what you inject by conservation of mass has to expand once you put it into this, you know, confined boulder zone. And, that, you know, the hydraulic gradients associate with that radial expansion far exceeds the regional gradient.

MEMBER KIRCHNER: Stewart?

MR. TAYLOR: Yes?

MEMBER KIRCHNER: A quick clarification.

Is there a decimal point off on one of those bullets? I can't imagine any water weighing 2.7 kilograms per meter cubed. Is that 27 or is that the delta? And, the cycled reclaimed water 2.7 kilograms per meter cubed.

MEMBER CORRADINI: I assumed it was the delta.

MEMBER KIRCHNER: Is that the delta?

MR. TAYLOR: Well, that's the total dissolved salts concentration.

MEMBER KIRCHNER: TDS? That's total dissolved salt? Oh, okay.

MR. TAYLOR: Yes.

MEMBER KIRCHNER: Not the weight of the water?

MR. TAYLOR: Correct.

MEMBER KIRCHNER: Got it, thank you.

MR. TAYLOR: So, I explained why we used a variable density flow and transport model. And, in developing this model, we made some assumptions. We assumed that the model was two dimensional, a radial symmetric, we assumed the boulder zone is

confined.

And, for the purpose of evaluating the horizontal radial extent of transport, that's a conservative assumption because it's forcing radionuclides laterally versus vertically.

And, in addition, we made an assumption that injection is continuous. We didn't consider the possibility of outages. Again, this maximizes the radial extent of transport.

And, in terms of the radionuclides of interest, we looked at four, tritium, strontium-90, cesium-134 and cesium-137. These are selected based on a screening analysis of the AP1000 source term.

We found that these four radionuclides would contribute about 99 percent of the dose in this case.

And, lastly, we assumed that no absorption occurred, that none of these four radionuclides interacted with the matrix that comprises the boulder zone.

So, for a radionuclide like tritium which is effectively water, it doesn't absorb anyway. So, you wouldn't expect tritium to be -- to absorb to begin with.

But, for the other radionuclides, the

cesium, the strontium, they would interact. And, if they were to absorb, it would take effectively increased their transport time, provide more opportunity for radioactive decay.

And, the assumption we made maximizes the concentrations in this case.

CHAIRMAN STETKAR: All right, and increase their concentration locally?

MR. TAYLOR: Well, there's --

MEMBER RAY: I think maybe is an accumulate locally would be a way to express it, right?

CHAIRMAN STETKAR: Well, yes.

MEMBER RAY: Yes, an accumulate -- I mean, my thought on that subject was this is a conservative assumption because access to the boulder zone where you might extract a piece of it that had absorbed these isotopes, I'll use the term that you challenged earlier, it wasn't a credible concern.

So, assuming that doesn't happen is conservative relative to the transport to another aquifer, for example. That's just the way I thought about it.

MR. TAYLOR: Yes, from a solute

transport perspective, you know, there's not a mechanism. I mean, if you're feeding, you know, some solute passing through porous media and it absorbs, there's no mechanism that would cause the water phase concentration to increase above concentration at which you inject.

MEMBER RAY: No, but if somebody accessed that place where it -- we talked a little offline about cases where concentration has occurred.

It's conceivable that it could concentrate over time and that concentrated mass could become of concern, but you'd have to access to it was the point I was trying to make, Charlie.

MEMBER POWERS: I certainly don't have any trouble assuming that cesium is nonabsorptive if there's no clay component in this boulder zone. But, it's pretty hard to imagine strontium doesn't isotopically replace with calcium in the limestone material.

MR. TAYLOR: So, your question is about strontium? Potential for strontium --

MEMBER POWERS: Yes, strontium would just exchange with the calcium in the limestone. And, I think it does exactly what you said, it just

slows down the transport --

MR. TAYLOR: Right.

MEMBER POWERS: -- climb on strontium. It's not going to concentrate it, it just --

MR. TAYLOR: Yes, so --

MEMBER POWERS: -- simply going to exchange.

MR. TAYLOR: So, the net effect, I certainly agree that it would retard the transport and ultimately decrease the concentrations that a receptor someone exposed to the water.

MEMBER POWERS: Yes, I mean, if your receptor's out in the ocean someplace, it's just going to slow down the transport time.

And, similarly with the -- if there's any clay component in the boulder zone, you don't indicate any of it, but, that will absorb the cesium and desorb it, I mean it's an absorb desorption phenomena and it just slows down transport time, the net effect is --

MR TAYLOR: Correct, yes.

MEMBER POWERS: -- to simply slow down transport time.

So, tritium is more, I mean there are a lot of arguments, but we don't get a lot of isotopic

exchange with TH2.

VICE CHAIR CORRADINI: I just wanted to make sure, these were going to -- I'm sure people that understand the risk of this more than I, but, your most credible incredible scenario, I can't come up with a better word, is essentially sampling this region at the boundary?

I'm trying to understand --

MEMBER RAY: Why do you say at the boundary?

VICE CHAIR CORRADINI: Well, because I looked up two slides further and I see some piece of private land and I assume somebody assumes somebody drilled down and started sucking on it.

MEMBER RAY: I thought you meant the boundary or the boulder zone.

VICE CHAIR CORRADINI: No, no, no, no, no, the boundary of their -- but, am I -- is that --

MS. RICHMOND: That's correct.

VICE CHAIR CORRADINI: Okay.

MR. TAYLOR: Yes.

VICE CHAIR CORRADINI: Thank you.

MR. TAYLOR: That's ultimately what we're --

MS. RICHMOND: Ultimately, that's

correct.

MR. TAYLOR: -- going.

MS. RICHMOND: Yes.

VICE CHAIR CORRADINI: Thank you.

MR. TAYLOR: And, can I have slide 81, please?

So, with this so called radial transport model, and there were questions raised earlier, well, you know, how far does this plume propagate?

And, so, these are results representative results from the groundwater model and there's a lot of information on this slide.

So, on the right side, it's a plan view of the Turkey Point site and, you know, you concentric circles drawn. And, the center of that circle represents where the centroid of the injection well field. We modeled this a single injection well, putting all the flow into the single injection well.

So, what you'd expect over time is, that this, as you inject water into the boulder zone itself, this bubble or cylinder or whatever you want to call it, is going to expand radially in all directions because there is a very -- a regional gradient inland is very, very small.

So, that's the sort of conceptually what you would expect. And, you see on here a -- something called a closest private parcel which is 2.2 miles away from the centroid of the injection field. And, I'll talk about that in a little more detail.

But, that is a location that's considered a hypothetical receptor. So, this is the point of interest where some MEI could potentially, through some scenario, potentially be exposed to the water in some shape or form.

If you look in the left hand side of the slide, these represent the results from the SEAWAT model. On the left hand side, that represents where the injection well occurs. The right hand side is the radial distance away from the injection well.

The injection well penetrates about half the thickness of the boulder zone, which we're taking to be 500 feet.

That hypothetical receptor location, 2.2 miles away, we take it at the surface of the boulder zone.

And, what you can see, these panels represent the progression of this plume over time. So, the first one is one year, next one three years,

ten years, 30 years, then we get to 61 years when Units 6 and 7 have shutdown and injection ceases at that point.

But, what you see is, is the concentrations here represent the tritium, you know, the red indicates high concentrations, the blue represent lower concentrations.

You're seeing this bubble or cylinder expand over time because the injectates less dense than the boulder zone water. You're also seeing it float to the top of boulder zone.

That's one of the reasons why we considered the hypothetical receptor location at the top of the boulder zone to give us the highest concentration to use for the dose analysis.

MEMBER RAY: Releases to the ocean and resulting pickup by marine life is just not a consideration here because there's no nearby boulder zone communication with the ocean, is that --

MR. TAYLOR: Well, the outcrop of the boulder zone would be many miles to the east or along the continental shelf would be off this map.

MEMBER RAY: Yes, I have picked up on the fact that the natural drift, apparently, is inland not toward the ocean. Okay.

MEMBER KIRCHNER: Stewart, just so I understand, the top of each of those one year, multiple year plots, is that just assumed that the boulder zone is like a hard cap zone? Or, is there actual -- is there some shape? Is there some diffusion into the confining unit above it, the next level of --

MR. TAYLOR: Yes, so --

MEMBER KIRCHNER: -- the units.

MR. TAYLOR: So, for this particular model, we assume that both in the top and bottom of the boulder zone were impermeable, so there's no fluid transfer vertically out of the boulder zone.

MEMBER KIRCHNER: Cap stone?

MR. TAYLOR: Like a cap stone.

And, we made that assumption purposely because, as we constrain the flow to the boulder zone in terms of the hypothetical receptor, what that does, it minimizes the travel time and maximizes the radionuclide concentration to hit that receptor.

Now, there's another model that I'll describe in a few minutes that, you know, looks at the potential for vertical -- upward migration at the boulder zone.

CHAIRMAN STETKAR: This tells me that if I operate those plants for 500 years, the profile will not change.

MR. TAYLOR: That's correct. You -- what happens is --

CHAIRMAN STETKAR: Is this an equilibrium?

MR. TAYLOR: Well, you actually -- you don't quite get to an equilibrium.

CHAIRMAN STETKAR: No, it's not.

MR. TAYLOR: But, if you -- you will reach a steady state. But, what happens is, that you start getting some mixing of the injectate with the native boulder zone water which tends to dilute the concentrations a little bit.

And, you'll see this on the breakthrough curves on the next slide.

CHAIRMAN STETKAR: Okay.

MR. TAYLOR: But, then once the plant shuts down, you know, it actually shrinks, as indicated.

CHAIRMAN STETKAR: Yes.

MR. TAYLOR: Okay, slide 82?

So, I indicated this location of the receptor and what's presented on this slide is the

time history or breakthrough curves at the hypothetical receptor.

So, this plot graphs the relative concentrations as a function of time at the receptor location for the four radionuclides of interest.

This shows that it takes about roughly ten years for the radionuclides to breakthrough or to get to that hypothetical receptor location 2.2 miles away.

Concentrations increase. You do see a peak in the concentrations, they start to slowly taper off over time. And, that's occurring because of that mixing of injectate with the native boulder zone water. There is some dispersion that occurs across that interface which causes the concentrations to be reduced.

And, then, at year 61 when both plants have shutdown, the source, you know, injection ceases, the source of radionuclide is shut off and then the concentrations fall off after that, you know, primarily due to radioactive decay.

MEMBER KIRCHNER: Let me ask another question.

What does this curve, Stewart, tell us, that someone after ten years drilled a hole into

that zone and then released it and that would be the exposure you would see?

MR. TAYLOR: What these curves tell you is, if you were to drill and observation well to the top of the boulder zone --

MEMBER KIRCHNER: Yes.

MR. TAYLOR: -- and monitored the radionuclide --

MEMBER KIRCHNER: That's what you see there?

MR. TAYLOR: -- concentrations over time, this is what you would see.

MEMBER KIRCHNER: Okay.

MR. TAYLOR: Right.

MEMBER KIRCHNER: So, how credible is it for someone to do an unauthorized -- I mean, this would be an expensive, extensive drilling operation, is that a credible event?

MS. RICHMOND: It is one which we assumed in order to come up with a dose for comparison with the 10 CFR --

MEMBER KIRCHNER: Thank you.

MEMBER BALLINGER: Not only would he have to drill, but he'd have to go there.

MEMBER RAY: Well, we're about to do

that, so let's move on.

(Laughter.)

MR. TAYLOR: Okay.

So, I'm on slide 83, so, the other model that Mary talked about and I alluded to was vertical transport.

Looking how injectate might migrate into the overlying confining unit, you know, so called middle floored and confining unit.

So, specifically, the modeling objective here was to evaluate the potential for upward migration of injectate from the boulder zone through the middle confining unit to the upper floor to an aquifer.

And, again, SEAWAT used, the same variable density groundwater flow and transport code that was used for the radial transport modeling. This was used to simulate the injection of cycled reclaimed waste water -- cycled reclaimed water into the boulder zone.

And, the model results is that the -- indicated that injectates expected to migrate about 300 feet vertically upward into the middle confining unit.

For reference sake, the middle confining

unit is shown in lower tan -- the lower tan strata on this figure. And, that's, recall, that's about a thousand feet depth, so it's after, I believe, a hundred years of operation or per 60 years of plant operation, about 300 feet of migration of injectate into that confining unit would be expected.

And, so, the results of that is we conclude that vertical migration out of the boulder zone is not expected to be significant.

VICE CHAIR CORRADINI: You probably said it and I missed it. What makes it a confining unit? Just a lower diffusivity. It's a lower porosity or permeability of the --

MR. TAYLOR: Correct. The station all has to do with some people use permeability, some people use hydraulic conductivity. But, that's the ability of a porous media to transmit water.

So, a confining unit has a much lower hydraulic conductivity or permeability than the underlying boulder zone.

VICE CHAIR CORRADINI: So, the blue is more transportable than the ugly yellow?

MR. TAYLOR: Correct.

VICE CHAIR CORRADINI: Okay, got it.

MEMBER SKILLMAN: And, the 300 foot

penetration is based on this SEAWAT code?

MR. TAYLOR: Correct.

MEMBER SKILLMAN: And the permeability, assumed permeability characteristics of the middle Floridan Confining Zone?

MR. TAYLOR: Correct.

MEMBER SKILLMAN: Okay, thanks.

MR. TAYLOR: Okay, with -- I would ask if you have any other questions, I believe, Mary?

MS. RICHMOND: Okay.

MEMBER SKILLMAN: Before you go, is there any validation of the assumptions regarding the permeability of that zone for that analysis?

MR. TAYLOR: Well, there is an exploratory well, which was mentioned previously, and it's been converted to an injection well. And, you know, in the course installing that well, there was characterization.

So, we actually, in the modeling of the boulder zone itself, we used the transmissivity that was determined from testing of that injection well.

MEMBER SKILLMAN: Okay. But, how about this middle confining unit, the 300 foot penetration, this kind of gets to our concern that there could be, or if there were to be a hold up

zone, then how rapidly would that isotopic concentration that's being held up penetrate into that middle zone?

So, you, obviously, have some assumptions regarding the permeability of that 1,000 foot layer.

So, what is the basis for your assumptions for that permeability?

MR. TAYLOR: Yes, perhaps Robert Maliva, who actually did that modeling might be able to answer that question better than I.

MEMBER SKILLMAN: Okay, yes, please do.

MR. MALIVA: I'm Robert Maliva, I'm a hydrogeologist with WSP Parsons Brinckerhoff.

The model was based on the actual data that was collected during the drilling of EW1, particularly the bore hole geophysical logs were used to get porosity data. And, we used core data to get a porosity permeability transform that we could use to populate the model grid.

And, we also performed a sensitivity analysis where we increased the transmissive vertical hydraulic conductivity of the confining unit. And, so to analyze it more worst case scenario.

So, again, basically, it was based on the actual field data and the 300 foot vertical migration, that's just the upper part of any effluent detection. You know, it's not the -- it's not a dispersive mixing as it move up, so that would be the first trace of any of the injected water.

It's not the pure reclaimed water reaching 300 feet. So, again, you get quite a bit, you know, a very large degree of dilution at that 300 foot level.

CHAIRMAN STETKAR: Okay. And, the reason that you're confident that your single core sample is representative of the entire structure is what?

MR. MALIVA: Well, the geology that we encountered at the exploratory well is comparable to the basic geology that we saw at the -- there's a Florida Keys Aqueduct Authority well to the west, I'm sorry, to the west as well as at the south district plant that is, you know, the basic geology strata is similar as well as just the core plug data.

In fact, we used some of the data from multiple sites to get the transform. So, it's comparable geology at these sites.

CHAIRMAN STETKAR: That's what I was looking for is the multiple sites. Thank you.

MEMBER SKILLMAN: Thank you.

MS. RICHMOND: Okay. Slide 84?

Okay, so once we developed some of the attributes of the system, especially including the groundwater transport that Dr. Taylor had given, we began to develop the scenarios as to try to figure out how somebody could potentially ever be exposed to the water.

So, it's really important to note that, when we undertook this, we talk about credible and noncredible scenarios, but we really had to make some extraordinary and incredible assumptions to be able to get a dose, as you'll see as we start to present some of these scenarios.

We looked at the different potential exposure models, which included both normal, off-normal operations and a special case called the inadvertent intrusion.

We also defined the potential member of the public locations which we included the plant area, property area and beyond the property area.

As we developed these scenarios, we came up with two scenarios that were ultimately developed

at the 2.2 mile receptor which is the closest receptor parcel of land to the property where a member of the public could gain access.

So, the two that were moved forward were off-normal and the inadvertent intrusion which came up to be the bounding scenario.

Slide 85, please?

So, a little bit about this scenario. At this scenario, the member of the public that drills a well into the upper Floridan Aquifer which is immediately above the failure in the middle confining unit.

So, what we came up with is, there's a failure in that confining unit right at the 2.2 mile marker, as the travel. And, the reason this is important is because the boulder zone, as Dr. Taylor was describing, the flow of water, because of the pressure, is greater than it would be than if it was in the upper Floridan.

So, there's a failure there either due to an abandoned well or some other thing.

Then a person comes in right above that failure and drills a well into the Upper Floridan Aquifer, right above the middle confining unit. So, all this has to happen for this to happen.

Effectively, the person would be drilling a well, because we didn't take into account any dilution when -- as the water rose up through the confining unit into the Upper Floridan. No dilution was credited.

So, effectively, it was if somebody -- a member of the public came in and drilled directly down to the boulder zone, same concentration was used in our dose scenarios.

So, we have a member of the public that drilled this well down into the Upper Floridan Aquifer which was where the boulder zone water came right directly up with no dilution.

So, we -- and the exposure pathways that were considered in the dose analysis include the injection of the water and irrigated vegetables, milk and meat.

So, that is, we made him a subsistence well driller. So, he's not only going to be drilling the well, he's also going to be drinking the water, using that water for irrigation, milk and meat.

MEMBER BALLINGER: This water is brackish.

MS. RICHMOND: Exactly. And, that's one

of the things that we're going to say. You know, it's going to pretty hard for him to unknowingly drink the water, but in order to get a dose --

So, as you can see, we had to make some really extraordinary assumptions, but we wanted to make sure you have a bounding dose to ensure that we're in compliance with the 10 CFR 50.

CHAIRMAN STETKAR: On your preceding slide, that's a little bit misleading. The Upper Floridan Aquifer is normally brackish water, is that correct?

MS. RICHMOND: Correct.

CHAIRMAN STETKAR: Okay.

MR. TAYLOR: Yes.

CHAIRMAN STETKAR: Your slide 83 leads me to believe, it says base of underground source of drinking water that's -- you're just assuming it's drinking water.

MR. TAYLOR: Well, this is --

CHAIRMAN STETKAR: Not in the real world?

MR. TAYLOR: Yes, this is Stewart Taylor.

So, the definition of brackish water, I think one of the criteria is it's in excess of

10,000 milligrams per liter and that's something that you would definitely notice if you were to consume the water.

MEMBER BALLINGER: Sea water is 19,000, right, PPS?

MR. TAYLOR: It's chloride, so I'm talking 12 solids.

MEMBER RAY: There's value in conservative assumptions and certainly drinking brackish water is a conservative assumption. But, nevertheless, to try and get to a result here that we can --

MS. RICHMOND: Correct.

MEMBER RAY: -- look at, we just keep in mind these are conservative assumptions.

MS. RICHMOND: Right.

CHAIRMAN STETKAR: They are assumptions.

MEMBER RAY: In an arbitrary model, yes.

MS. RICHMOND: Right. Okay.

CHAIRMAN STETKAR: Well, go on. I have another scenario.

MS. RICHMOND: So, in addition to the individual that's drilled the well, ingested the water, irrigating vegetables and milk and meat, we also have another part of that dose has to do with

him actually drilling the well and being exposed as he brings out that water from the boulder zone that's now in the Upper Floridan.

And, that included the inhalation of the airborne containments and the vapor cloud formed from seen it in the puddle of the drilled water.

We also looked at the immersion of him being in the liquid puddle and exposure to the direct radiation from contamination of the puddle formed on the ground during the drilling of the well.

And, we applied all these into the dose.

Next slide, please?

And, the injection doses were calculated using the LADTAB II computer program. This is some of the assumptions in the model include the effective decay time transit for each radionuclide was based on the concentrations at the injection point.

A separate LADTAB II run was made for each radionuclide that Dr. Taylor discussed, tritium and the cesium and strontium.

We also looked at it for 365 days a year. It was scaled to do that, so we assumed operation was for 365 versus the 292, so it was the

-- it was scaled.

MEMBER SKILLMAN: Mary, where does the 292 come from?

MS. RICHMOND: That's what the DCD Table 11.27 values are assumed from, am I correct, Ken?

CHAIRMAN STETKAR: Is that right? The DCD assumes that no rad waste is produced when you're in an outage? It wasn't my experience, of course, I never operated an AP1000, we tended to produce more rad waste during an outage, but that's okay.

MS. RICHMOND: I think it's more that it's not really --

MR. JHA: I think it's produced, perhaps, but it's not released. They assume it's released 292 days a year.

This is Ken Jha, sorry.

That's the assumption in the effluent that's released to the environment.

CHAIRMAN STETKAR: Okay. That's an assumption, okay. It's the same thing, you know, you can assume whatever you want to assume as long as we know --

MEMBER RAY: What it is.

CHAIRMAN STETKAR: -- what was assumed.

MEMBER RAY: Yes.

And, we conclude it's conservative.

MS. RICHMOND: Correct.

The LADTAB II, two runs are for two units.

MEMBER RAY: That was a prohibited word, I'm sorry.

(Laughter.)

MEMBER RAY: We conclude it won't be exceeded, I should have said it that way, I guess.

MS. RICHMOND: For two -- that's okay, opportunity.

This is consistent with the SEAWAT model and this is, when you have two units, you're going to get more pressure bringing it out faster, so Ken assumed for two units.

And, we talked a little bit about the doses during drilling via inhalation, immersion and deposition pathways were all considered.

The evaporation, to get an evaporation rate, we used the Environmental Protection Agency guidance to evaporate the puddle to get the maximum evaporation rate so that he be inhaling it.

Next slide, please?

And, this slide presents the capilated

bounding MEI dose. And, I apologize, there's a little bit of a typo there, it's a subsistence driller dose summary.

So, as you can see, even with the incredible assumptions that we had to make to get the dose, it's still below the 10 CFR guidelines.

CHAIRMAN STETKAR: Just for the record I want to make sure that any use of the term "credible and incredible" is completely arbitrary based on the assumptions that you made. Now I understand you have an agenda, but based on the assumptions that you made, this is the result that you had.

MS. RICHMOND: Correct.

CHAIRMAN STETKAR: Okay. Thank you. Please don't use the word "incredibly incredible," or any of that in your further testimony.

MS. RICHMOND: Next slide. Eighty-eight, please.

This slide highlights some of the assumptions that were involved in coming up with a dose.

CHAIRMAN STETKAR: Under the third sub-bullet you say he, this subsistence driller effectively drills into the Boulder Zone. I thought you told us that the stuff had migrated up into the

Floridan aquifer. So he don't have to drill into the Boulder Zone, does he?

MS. RICHMOND: Effectively.

CHAIRMAN STETKAR: Well, no, you said there was a fault that you had assumed, that there was a fault in the -- I get all of the terminology there wrong -- a fault in the Middle Floridan Confining Zone allowing the stuff to go up into the upper Floridan aquifer. Well, now you're telling me, well, no, this guy has to have drilled all the way down through all of that stuff, right?

MS. RICHMOND: No, what I'm saying is --

PARTICIPANT: It's as if --

PARTICIPANT: It's all effectively.

CHAIRMAN STETKAR: Effectively?

MS. RICHMOND: Effectively.

CHAIRMAN STETKAR: Ah, okay.

MS. RICHMOND: Because --

CHAIRMAN STETKAR: Effectively drills. Okay.

MS. RICHMOND: But the water in the Boulder Zone, that water is the water that we assumed went right up to the --

CHAIRMAN STETKAR: I know. No.

MS. RICHMOND: -- aquifer with no

dilution, no mixing with the upper Floridan.

CHAIRMAN STETKAR: Okay.

MS. RICHMOND: So in order to really get that kind of concentration, you're going to have to -- this is like magically going up right into the upper --

CHAIRMAN STETKAR: Right.

MS. RICHMOND: -- Floridan, that whole --

CHAIRMAN STETKAR: Let me ask you what happens if you have a major fault in your injection piping and your detection wells don't detect it because stuff goes up and you're sucking from the bottom? How are you going to detect it and could it be released directly into your upper Floridan aquifer without all of the assumptions? Can that happen?

(No audible response.)

CHAIRMAN STETKAR: We have many examples in the real world, not like this, where things were going where people didn't think they were going and thought that they knew that they weren't going there because their monitors didn't tell them -- their monitors weren't located in the right place. So can you get a fault in your injection piping such that

you're pumping stuff out directly into the upper Floridan aquifer and not know it because of the locations of your monitor wells?

MR. TAYLOR: So this is Stewart Taylor. So that -- if there were --

CHAIRMAN STETKAR: It might not change your dose, by the way. I'm just trying to challenge your notion of how you've come up with your scenarios and what is credible and what is incredible based on experience.

MR. TAYLOR: Okay. So the -- if there were a leak and that leak made its way to upper Floridan aquifer -- the upper Floridan aquifer flows towards the sea --

CHAIRMAN STETKAR: Okay.

MR. TAYLOR: -- so that is flowing away.

CHAIRMAN STETKAR: Away from this one? Is the transmissivity high or low or --

MR. TAYLOR: It's high.

CHAIRMAN STETKAR: It's high? Okay. Thank you.

MEMBER REMPE: I look back at this table on slide 87. You've assumed after he does his drilling, which doesn't contribute a lot to dose, that he uses that water for a year, and that's why

he gets an annual ingestion of water in irrigated foods --

MS. RICHMOND: Correct.

MEMBER REMPE: -- which is really driving your dose estimate.

MS. RICHMOND: Correct.

MEMBER REMPE: So again, you've only got a three millirem margin with this very unusual scenario. I didn't use "incredible."

(Laughter.)

MEMBER REMPE: No, but again, why didn't you have to use the A2 operating units? Why didn't you consider them, too? Is there something that guarantees that there's not going to be some other -- however they discharged their water to whatever, that they didn't get a little more of a dose from those other two units?

MS. RICHMOND: Three and four discharge their water to the cooling canal systems which is located on the property.

MEMBER REMPE: Yes. But they don't have any -- there's no water that gets reused somehow or other and he uses that also to water is crops or whatever, or he goes and has a drink down at city hall one day or something and -- or, I mean, there's

-- why can you just totally ignore the fact there's two other units in this analysis, is what I'm really --

MS. RICHMOND: I think Ken Jha --

MEMBER REMPE: -- trying to ask.

MR. JHA: Well, this is Ken Jha again. It's back to the earlier question I guess. I think you had asked the same question before.

MEMBER REMPE: Yes.

MR. JHA: It was about why wouldn't be adding the dose from the four units? But it's because of different locations. They're not --

MEMBER REMPE: Well, the maximum individual is located at a particular --

MR. JHA: Yes.

MEMBER REMPE: -- location for these --

MR. JHA: Right.

MEMBER REMPE: -- two units --

MR. JHA: Right.

MEMBER REMPE: -- but that individual might have some contribution and he --

MR. JHA: Actually --

MEMBER REMPE: -- and I'm just wondering how come that can be totally --

(Simultaneous speaking.)

MR. JHA: Yes, you're right.

MEMBER REMPE: If you're considering both of these units, why not four units?

MR. JHA: Well, this is for Appendix I where you're looking at the dose per unit. When we looked at compliance with 40 CFR 190, which look at all units on site --

MEMBER REMPE: Yes.

MR. JHA: -- for that we did include Units 3 and 4, and it was very small compared to this.

MEMBER REMPE: So this --

MR. JHA: Orders of magnitude lower.

MEMBER REMPE: So this is just the way the regulation's written?

MR. JHA: Yes.

MEMBER REMPE: You only have to consider these two and not --

(Simultaneous speaking.)

MR. JHA: Well, even here we're doing per reactor. So even though it's -- so the dose in that table is for one unit, because Appendix I limits our per unit.

MEMBER REMPE: Yes, but the limits are per unit, but you consider two contributing --

MR. JHA: Two because it pushes the plume out faster. That's why we -- our model is based on --

MEMBER REMPE: But you just --

MR. JHA: -- two units, but we divided the dose by two --

MEMBER REMPE: Okay.

MR. JHA: -- to show compliance with Appendix I.

MEMBER REMPE: Okay. Thank you.

MEMBER RAY: We have a new slide up there and I think you're going to talk about that, or are you done talking about it?

MS. RICHMOND: Yes, I think we're finished talking about that. We've gone into --

MEMBER RAY: You've got more that says questions, I think. There we go.

MS. RICHMOND: There you go.

(Laughter.)

MEMBER RAY: I was waiting for that. I didn't know if you were done with the preceding slide.

MS. RICHMOND: Yes.

MEMBER RAY: Okay. More additional --

MEMBER CHU: I have one question.

CHAIRMAN STETKAR: Margaret?

MEMBER CHU: I have one question, yes. Can you clarify exactly what's the radionuclide concentration you use when the driller start --

MS. RICHMOND: Drilling?

MEMBER CHU: Yes.

CHAIRMAN STETKAR: Margaret, speak to the mic because we're not --

MEMBER CHU: Oh, okay.

MS. RICHMOND: The actual concentrations?

MEMBER CHU: Yes, the actual -- can you clarify exactly how you use the concentration of the radionuclides at the drilling point when start ingestion and all that?

MR. JHA: Yes, this is Ken Jha. That comes from the DCD, the DCD table that's referenced in 11.2.8, I believe it is. That shows what gets released to the environment. So that's the concentration at point of injection based on the -- it's based on the dilution flow that we -- 6,000 ppm that -- that's a little bit higher for the site-specific --

(Simultaneous speaking.)

MEMBER CHU: So it's not what you're

calculating? You show me all these peak concentration as a function of time. There's a 2.2 line. That's not actually -- I was wondering whether you're using the peak concentration from your calculation. Turns out no?

MR. JHA: Well, that -- okay. What's from the DCD is the concentration at the point of injection. What those graphs were showing is how those concentrations change as you go radially away through the Boulder Zone.

MEMBER CHU: It's at the injection point?

MR. JHA: Those are part -- well --

VICE CHAIR CORRADINI: Can we go to slide 82? I think that's what Margaret's asking.

CHAIRMAN STETKAR: Eighty-one or eighty-two.

VICE CHAIR CORRADINI: I mean, for clarification that's a dimension of C over C0. C0 is what the DCD specifies. C over C0 is a fractional amount that appears at a location where you suck it up. Right?

MR. TAYLOR: That's correct.

VICE CHAIR CORRADINI: Eighty-two. Slide 82 I think is what Margaret's asking. I

thought --

MEMBER RICCARDELLA: The next one. I assume this guy drilled his well at year 30, or something like that, right?

MR. TAYLOR: This is Stewart Taylor. Even though the peaks don't occur at the same point in time, then the peaks were used even though they didn't --

MEMBER RICCARDELLA: Okay. Yes.

MEMBER CHU: So you're using the peaks?

MS. RICHMOND: Right.

MEMBER CHU: Okay.

MS. RICHMOND: Each peak. We used each peak, right.

MR. JHA: Yes, in calculating the dose we assumed the peak concentration of each isotope.

MR. ORTHEN: This is Rick Orthen. It's the last bullet on slide 80.

MEMBER RAY: To questions again. Anything else?

VICE CHAIR CORRADINI: I guess I wanted to get back to John's question in the sense that did you methodically try to come up with other ways to get a larger dose and failed, or did you just by inspection think this one was the bounding one?

That's what I'm -- another way of asking I think John's question.

MS. RICHMOND: Okay. We looked at several -- there was two scenarios that we actually did a dose analysis for. The one that we presented was the bounding scenario. We also looked at a person who might be drilling into the middle -- above again the middle confining unit failure, but this time drinking the water as if it was a public water system. And of course that dose was much better.

But we had a myriad of other scenarios that we looked at for migrations. Every -- if we -- we almost had to assume that there was a failure in the middle confining unit to get any kind of dose because during the modeling when you look at -- it would only go up -- it would take so much longer if there was a failure before that 2.2 mile marker because the travel time would be much greater. And that was -- do you remember, in the order of -- there. It was much greater travel time. And then you would also be getting the dilution in with that if it was traveling in another zone.

So that had to do with some of the -- we always had to assume that middle confining unit

failure in order to get that dose, and it was at what point is that we had to get that transported out to that --

MEMBER RAY: We'll find the --

MS. RICHMOND: -- individual.

MEMBER RAY: We'll find the staff had to do the same thing when they come up. Other questions?

MEMBER KIRCHNER: Mary or Stewart, is there anyone drilling in the vicinity of your plant into that upper Floridan aquifer for any purpose?

MS. RICHMOND: Yes, David McNabb, would --

MR. McNABB: Yes, this is David McNabb. Yes, actually FPL is currently in the process of installing some Floridan aquifer production wells at the site.

MEMBER KIRCHNER: And the water is used for what purpose, for cooling or --

MR. McNABB: I know at least some of it is being added to the cooling canal system for 3 and 4.

MEMBER KIRCHNER: Yes.

MR. McNABB: I am not sure if additional water is being used for cooling or not. I'm hoping

maybe that --

MEMBER KIRCHNER: But not for drinking water purposes?

MR. McNABB: You are correct.

CHAIRMAN STETKAR: I don't know anything about water. Can you use this water for -- actually use this water, the upper Floridan water for agriculture? And statewide, if this was an aquifer, do people do that?

MEMBER RAY: I don't know. It would --

(Simultaneous speaking.)

MR. McNABB: I'm sorry. David McNabb again. In South Florida it is not used for agriculture. Too brackish. As we move to mid-state the upper Floridan gets a lot shallower and fresher and is --

CHAIRMAN STETKAR: Okay. Yes.

MR. McNABB: -- has been used.

CHAIRMAN STETKAR: Okay. Thank you.

MEMBER RAY: Anything else?

MEMBER BALLINGER: For reference purposes normal potable water, the chloride limit is about 100 ppm.

MS. RICHMOND: And the EPA drinking water standards, secondary standards for TDS are 500

milligrams per liter, as a comparative value.

MEMBER RAY: Okay. Thank you. No surprise, we're now an hour late according to the schedule. We have the staff. I want the staff to know that tomorrow is Friday, so we are going to go a little later today, not past 6:00. And we do have an obligation to hear from members of the public who are on the line.

The staff is scheduled for an hour and 10 minutes. My guess is that before they're done it would go longer than that. Therefore, what we're going to ask is that the staff come up, we begin their presentation, but be aware that in order that we can get any input that is needed from the members of the public and have any discussion required among the members before we leave, we will find a place before 6:00 to stop the discussion if it's still ongoing and resume it in the morning.

With that, I'd ask, Manny, that we come up.

You guys are done, aren't you?

MR. TAYLOR: Yes.

MEMBER RAY: Okay. All right. You looked like maybe you wanted to do something more and I thought maybe I was --

MR. BURKHART: Just as we're getting set up with our presentation, I'm Larry Burkhart, the Chief of the Radiation Protection and Accident Consequence Branch. We've been engaged with FPL on this issue probably for --

MEMBER RAY: Is your speaker -- or microphone on?

MR. BURKHART: It is.

MEMBER RAY: Okay. Very good. Go ahead, Larry.

MR. BURKHART: We've been engaged with FPL on questions and answers on this issue for about four years, so we realize you just have one day that you're -- we're discussing this right now. So with that, I'd just like to turn it over to Zachary Gran, who's our health physicist. And in case we have any questions that need to be asked, we have Dan Barnhurst, who's a hydrologist here. So --

MEMBER RAY: Is there any member of your group, Larry, that would not be available tomorrow, because -- morning, because we need to give them precedence.

MR. BURKHART: I think we will make ourselves available.

MEMBER RAY: Okay. All right. Well, if

you think this is tough to do in two days, just wait until we do it in two hours at the Full Committee. But then fortunately most of the Full Committee is here.

MR. BURKHART: So, Zach?

MR. GRAN: All right. Hello, all. Like Larry said, my name is Zach Gran. I'm a health physicist in NRO. I'm here to discuss 11.2, liquid waste management systems.

Next slide, please. For background, Turkey Point Units 6 and 7 would use deep well injection to dispose of liquid waste. The staff's offsite dose analysis conservatively considered an unlikely full breach of the middle confining unit without considering dilution or decay from the Boulder Zone to the receptor location. So that would be for considering an instantaneous transport from the Boulder Zone to the receptor.

Staff relies on the existing regulatory framework from the Florida Department of Environmental Protection, FDEP, and the regulation and construction of the deep well injection systems. As such, the staff did not evaluate the integrity of the deep well injection piping and acknowledged the existing integrity program run by the state.

The applicant provided information to comply with 10 CFR 20.2002 alternate disposal requirements, and the 10 CFR Part 20 Appendix B requirements are met at the point of discharge.

MEMBER RAY: The point of discharge being the same as the point of injection?

MR. GRAN: Yes, so the moment it gets into the ground, it's -- you can definitely consider it meets Part -- or Appendix B of Part 20.

So additional background. This should be a somewhat familiar picture from our 2.4 presentation, but the background is we have the layers here and the -- so the water is injecting into the Boulder Zone, the lower Floridan aquifer. The State of Florida has 180 Class 1 underground injection control wells, and these wells are permitted in a three-stage process: exploratory, construction and operation.

Turkey Point proposes the use of 12 Class 1 injection wells for the site and 6 dual-zone monitoring wells. Injection rates by source are 18 million gallons per day of reclaimed water and 83 million gallons per day of salt water from the radial collector wells.

The staff identified that since --

MEMBER RAY: That's an "or" rather than an "and," right? Either 18 for the -- or --

MR. GRAN: Yes, because that's --

(Simultaneous speaking.)

MEMBER RAY: You said "and," and I just want to --

MEMBER BALLINGER: Is that assuming 365 days? I believe it's limited to 60, right?

MR. GRAN: Six --

MEMBER BALLINGER: The salt water injection from the collector wells.

MR. GRAN: There's a limit to the amount you can inject from salt water. So, I mean, these are -- like he said, it's an "or." So it's -- the primary source of injection would be the reclaimed water, and you could -- we mentioned the salt water just because it's also another -- a method of liquid going to the Boulder Zone.

MEMBER RAY: As the applicant said, if you're using seawater for cooling, you've got to inject a heck of a lot more than if you're not.

MR. GRAN: The staff identified that since FPL was not releasing a liquid effluent to a surface body of water that it would be necessarily to apply for an alternate disposal method.

So the 10 CFR 20.2002, these are the four criteria listed there. And also given other requests that staff had received in non-plant space that the requirement -- the staff has accepted requests that result in "a few millirem" of exposure. Given this, the staff has selected or approved the 10 CFR Appendix I criteria as evaluating -- as a criteria for evaluating dose since this is normally followed for licensing.

I'll also point to these sub-bullets that we have. I've referenced the SECY papers that help discuss the "few millirem" criteria.

The staff performed an independent analysis using the concentrations described by the applicant. The concentrations of the radionuclides described by the applicant with the highest contribution to dose were determined to be conservative through independent verification performed by staff. Considered in this analysis are tritium, cesium-134 and 137 and strontium-90. As the applicant stated, these four radionuclides contributed 99 percent of the dose from the AP1000 nuclide mix, and this was confirmed by wide tap runs with all the radionuclides and the four selected as comparisons.

The staff used the DCFs and -- or the dose conversion factors and consumption factors described in Reg. Guide 1.109. The staff assumed a full breach of the middle confining unit in its analysis. This assumes that the concentration in the Boulder Zone is being considered at our receptor location. No removal is being considered.

The staff -- or it was identified that there were two receptor locations: one at 2.2 miles northwest and 7.7 miles southeast of the site. The 2.2 mile distance is what we considered for the analysis.

The pathways considered were based on the use of water practices in the Miami-Dade County Comprehensive Development Plan. Review of these plans show that individual potable water systems including private drinking water wells are not considered -- the wells are considered interim facilities and when a public water supply is not available. Considering this, the staff determined that drinking water is an unlikely pathway, however, the staff did observe a number of sources of groundwater for irrigation.

Staff considered in its analysis the middle confining unit is 1,500 feet thick. Again,

the full breach scenario. No decay from the Boulder Zone to the top, to the upper Floridan aquifer. There's no dilution being considered; no additional removal being considered. So like I'll restate, we have a concentration in the Boulder Zone and we assume the same concentration in the upper Floridan aquifer.

The staff considered the following scenarios: Well failure and release of effluent into the upper Floridan aquifer. This was not considered bounding because, first, core re-sampling of the monitoring wells are performed. If a well failure was detected, remedial actions would be taken to stop the leak. Also, if effluent was released from the Boulder Zone to the upper Floridan aquifer, the effluent would first be diluted by the upper Floridan aquifer and the flow of this aquifer is west to east, away from our receptor locations.

The second scenario. Upwelling of injectate from the Boulder Zone through a competent middle confining unit. This assumes that there is no direct pathway for the liquid effluent to travel from the Boulder Zone to the middle confining unit. This was not considered bounding because based on staff analysis upwelling is limited to the bottom

300 feet of the middle confining unit, which is 1,500 feet think. And I think a number in our SC was 220 based off our vertical analysis, transport analysis.

MEMBER REMPE: Out of curiosity --

MR. GRAN: Sure.

MEMBER REMPE: -- how do they repair a hole that's that deep?

MR. GRAN: Well, I'm not sure how they repair, but the State of Florida requires them to perform remedial action, so if they determine this through their pressure monitoring or their dual-zone monitoring wells --

MEMBER REMPE: Okay.

MR. GRAN: -- they'll have to be responsible for mitigating the effluent release.

MEMBER REMPE: That's happened in the past and they've been able to repair? I just am curious because there's other examples where I hear about these deep holes being dug.

MR. BURKHART: Well, the applicant would probably be better to answer that question.

MEMBER RAY: The applicant might? Yes, please. Thank you.

MR. McNABB: Yes, this is David McNabb.

Regarding repair, a well of this design, if we did pop a hole in that final casing, first of all, we would detect it right away because that annular space is under pressure.

MEMBER REMPE: Right.

MR. McNABB: So we would immediately detect it. The repair would involve removing the FRP liner. And you go into the well and there are a couple options. You could try to squeeze cement into the hole and drill that cement out and pressure test it, make sure that that fix worked. Another fix is coming in with a sleeve, something that's a slightly smaller diameter than the inside diameter of that pipe. You lower it to the right level. Then you take a tool and run it through that to sort of expand it against the wall of the casing, and thus another pressure test to demonstrate that worked. Install your liner and you're back in business.

MEMBER REMPE: Thank you.

MR. McNABB: You're welcome.

MR. GRAN: The third scenario considered was an inadvertent exposure to injectate on site. This scenario was not expected since site workers would be aware of the deep well injection and will

take the necessary precautions for any drilling that would need to be performed, if needed.

And lastly, the scenario that was considered was a full breach of the middle confining unit at 2.2 miles and the hypothetical well at the point of the middle confining unit breach. This was determined to be the bounding scenario which we will describe on the next slide.

So here is the same picture again, but we'll use this to step through our scenario. Reclaimed water is used in this dose analysis. This results in a higher concentration of radioactive effluent that would be used instead of salt water because we have a higher -- potentially a higher volume of salt water. Like the applicant stated, they will be calculating the releases, or permissible effluent releases, so this -- it could vary. But for this analysis we used the flow rates of the reclaimed water supply.

Next we have the water that is then pumped in the Boulder Zone of the lower Floridan aquifer. While in the Boulder Zone the only method of travel for radionuclides is by the injection flow rate. Under these assumptions it would take 25 years for tritium, 15 years for cesium-134, 42 years

for cesium-137, and 41 years for strontium-90 to reach their maximum concentrations at our receptor of interest.

For the staff analysis the maximum concentrations are used at -- for each radionuclide at 2.2 miles. The verify the concentrations at 2.2 miles the staff used parameters to minimize travel time and maximize concentrations using the conservative values for used decay, of dilution not really considered, the sorption, porosity and thickness of the Boulder Zone.

The then assumes a full breach of the 1,500-foot middle confining unit. This assumes that the maximum concentrations in the Boulder Zone at 2.2 miles exists at the hypothetical well in the upper Floridan aquifer with no dilution or decay assumed in passing through the middle confining unit. We then assume that the hypothetical well is placed directly over the breach and then said person uses the brackish water for irrigation and drinking water.

So the staff's conclusions. So based on the conservative assumptions stated by the staff the dose was determined to be below the limits. So 10 CFR Part 20, Appendix C. So we noted a batch

release. So first of all, you would be monitoring your tanks before releasing them. Compliance is met by specifying and maintaining the flow rates at the blowdown sump discharge corresponding to at least the minimum dilution factor prior to discharge. And this is I think at a minimum 6,000 gpm per unit for the AP1000 DCD.

And for 10 CFR Part 50, Appendix I the staff confirmed the results reported by the applicant through independent calculations and confirmed the doses were indeed below the design objectives.

Now for the conclusion on 10 CFR 20.2002. So we broke this down similarly to how the four bullets were described before. The waste disposed and manner of disposal has been adequately described. So ECLs of Part 20, Appendix B are met. The applicant files a design guidance of Reg. Guide 1.143. And the description of the injectate piping has been provided.

An analysis and evaluation of the nature of the disposal to the environment has been discussed in FSAR Sections 2.4.13, 9.2.12 and 11.2, and in ER Section 2.3.2.2. The nature and locations of potentially licensed and unlicensed facilities

are fully described. Staff has considered the locations of the MIE in the staff dose analysis, 2.2-mile receptor. And doses are maintained by demonstrating compliance against the limits of 10 CFR Part 50, Appendix I, and the maximum dose criteria of "a few millirem."

I think that's all of our slides.

MEMBER RAY: Anything else, Larry?

MR. BURKHART: I think that's it. Ready for your questions.

MEMBER RAY: Okay. Well, the staff has done a fabulous job of getting us back closer to our schedule by a long shot.

(Laughter.)

MEMBER RAY: So we appreciate that. Questions for the staff?

CHAIRMAN STETKAR: Can you go back to your, whatever it is, the picture slide there a couple ones backwards? Thanks. And this is -- I probably missed it. Can you remind me what the characteristics of the surface aquifer are?

MR. BARNHURST: I can do that. Again, this is Dan Barnhurst. I'm a hydrogeologist for the staff. So when you say the surface aquifer, you mean the Biscayne?

CHAIRMAN STETKAR: Yes, sir.

MR. BARNHURST: -- aquifer there at the site?

CHAIRMAN STETKAR: Exactly.

MR. BARNHURST: Okay. At the site the Biscayne is an EPA sole source aquifer, which means it's used for drinking water in other areas, but at the site it's salt water. There's been -- salt water intrusion has affected it and then there's been some issues on site as well. So it's not a drinking water aquifer at the site.

CHAIRMAN STETKAR: Okay. Where's the -- what's the hydraulic radiant on that? Which direction?

MR. BARNHURST: Which direction? Towards Biscayne Bay, which is to the east.

CHAIRMAN STETKAR: To the east? Okay.

MR. BARNHURST: Yes, same as with the upper Floridan aquifer, which is the next aquifer down.

CHAIRMAN STETKAR: Yes, okay.

MR. BARNHURST: Yes.

CHAIRMAN STETKAR: I know that the applicant has that double sampling well configuration there. Do they sample from the

Biscayne surficial aquifer also?

MR. GRAN: I think the dual-zone is only for the base of the upper Floridan and the -- I guess the upper portions of the middle confining unit.

CHAIRMAN STETKAR: So if I had a breach in the injection line in that upper aquifer I wouldn't detect it for sampling? I'd need --

MR. GRAN: Not with the dual-zone monitoring.

CHAIRMAN STETKAR: No. Well, is there other sampling that I detect it with?

MR. BARNHURST: Perhaps the applicants can speak to Biscayne aquifer wells on site that do monitoring, but I would defer again to the fact that between the 18-inch FRP line and that 24-inch casing it's pressurized. And so, when you -- if you were to have a leak, you would notice the pressure drop and you would be aware of it very quickly.

CHAIRMAN STETKAR: You would and I would on a piece of paper. We have evidence of a lot of people in places who should have been aware of things and weren't for a variety of reasons. So I'm not trying to do a quantitative probabilistic analysis here. I'm just trying to probe in terms of

what types of scenarios people might have thought about.

MR. McNABB: This is David McNabb. If I could address leakage into the Biscayne briefly. We do not have -- DEP does not make us install or monitor wells in the Biscayne except for during the construction of the well. After that they allow us to plug and abandon them so there's no monitoring of the Biscayne associated with the UIC well.

However, for water to reach that Biscayne you've got to go through a 54 -- well, through your 18-inch liner, your 24-inch casing, the cement between the 24 and 34, cement between the 34 and the 44. So it's -- there's a lot of barriers that must be breached.

CHAIRMAN STETKAR: Okay. Thank you.

MEMBER RAY: Anyone else?

MEMBER RICCARDELLA: Yes, I have a question. With this figure on the board, given the conservative -- the analysis that you did that assumes total loss of the confining unit, would you get essentially the same answer if you were somehow leaking directly into that upper Floridan aquifer? In other words, would the transmissivity between that point and the hypothetical well be about the

same as it is in the lower Floridan, or is the transmissivity different?

MR. BARNHURST: The transmissivity is different. The lower Floridan aquifer, the Boulder Zone has much higher transmissivity. So I would imagine that would affect your travel times. And so you could have --

MEMBER RICCARDELLA: Yes, so then it wouldn't be as bad? If for some reason you had a leak, it wouldn't be as bad as what you assumed, right? Is that what you're saying?

MR. BARNHURST: I would imagine, yes.

VICE CHAIR CORRADINI: But just to add to his question, I thought John asked the question of the applicant, and I thought the flow was east in the upper Floridan.

MR. BARNHURST: It is. Yes, but it also flows towards Biscayne Bay.

VICE CHAIR CORRADINI: Yes.

MEMBER RICCARDELLA: I see.

MR. BARNHURST: Yes, so you would expect in both those cases it would move off site towards underneath the bay. If it were to occur, and it's not expected to.

MEMBER RICCARDELLA: This guy might be

drilling out in the bay.

(Laughter.)

CHAIRMAN STETKAR: All facetiousness aside, if someone said that they did a performance analysis and looked at a broad -- systemically looked for scenarios -- I'm trying to probe how systematically and what types of scenarios they looked for. Or did they just a priori have one that they thought was going to be the worst and focused immediately on it? That's where -- that's the way I'm probing.

I'm not talking about where somebody's going to drill or why they're going to drill there or what the likelihood of getting a break in a pipe at a particular location or fractures in concrete, concentric concrete barriers or things like that, why they might have been broken or anything like that. I'm just trying to search for whether people have thought systematically about scenarios.

MR. BARNHURST: If I could add to that; and this is not related to radiological constituents, but again deep well injection, as has been mentioned, is widely used in Florida. And in my evaluation, in my review I came across two relative risk assessments that have been performed,

one by EPA in 2003 and another one in 2005 from a Florida water utility group, and it was chaired by professors from the local universities, hydrologists. And they looked at a number of different waste disposal options.

They looked at ocean outfall, they looked at canal discharge, they looked at deep well injection and determined that deep well injection had the lowest risk associated with it. Within deep well injection they looked at a number of different exposure scenarios. They looked at direct release to the Biscayne aquifer, so well failure. They looked at direct release or well failure to the upper Floridan aquifer and they also looked at total breach of the middle confining unit. And what they found is similar to what we've determined.

CHAIRMAN STETKAR: Good. Thanks. That's a confidence builder.

MR. BARNHURST: It was not radiological. It was the constituents normally in the --

CHAIRMAN STETKAR: Sure. Stuff.

MR. BARNHURST: -- injected waste water. Yes, but still, I thought it was very interesting.

CHAIRMAN STETKAR: No. Thank you.

MR. BARNHURST: You bet.

MR. FRANZONE: This is Steve Franzone with Florida Power & Light. The FSAR Section 11.2.3.5.2.3 -- it describes all this -- what we went through in the scenario development. And so in there you can see we went through off normal, normal, and we ended up with the grounding intruder scenario. So if you go to that section -- I'll give it to you again.

CHAIRMAN STETKAR: No, I looked at it.

MR. FRANZONE: Okay.

CHAIRMAN STETKAR: I was looking at it here, and you just missed my one the break in the upper Floridan aquifer as not feasible because you got super good pipe.

MR. FRANZONE: Yes. Okay.

CHAIRMAN STETKAR: I'm being pejorative, obviously, but it was dismissed as impossible.

MR. BARNHURST: That section of the FSAR was I think revised based on an RAI response, 6985, that was submitted to staff. It may have a little more information as well, if you're interested.

MEMBER CHU: I'm not sure I understood correctly an earlier slide from the applicant. It's about mixing and diluting the blowdown liquid with the radioactive waste, the two mixing and dilution.

I thought it says you have to dilute in such a point that it complies with 10 CFR.

MR. GRAN: That's correct. So what --

MEMBER CHU: Is that correct?

MR. GRAN: Yes, so what --

MEMBER CHU: So that's before your injection --

MR. GRAN: Correct.

MEMBER CHU: -- into the deep well?

MR. GRAN: See, what they're trying to achieve is they have a rad waste flow and they have a diluted flow and they're trying to get through the concentration in Part 20.

MEMBER CHU: But my point is I've been very puzzled by these low doses from the incredible scenarios, but when you think from the input perspective, it already complies with 10 CFR 20. So it doesn't matter how you do your scenario, how you mix or match the outlet. You still comply. To me that kind of explains the puzzle.

MR. BURKHART; I think -- when we started asking questions to the applicant, I think that was their first reaction. And quite honestly, that was my first reaction, too. At the time I was the Branch Chief of the Licensing Branch and that's

why we were asking this. And I think they -- staff went through a process to see was there a scenario where you could get a higher concentration even though it met the Class B limits when you put it in the ground? And I think that's why the upper Floridan and the Biscayne Bay, they -- I'm oversimplifying, that there's a lot of dilution. Down in the lower Floridan aquifer there is and it's all being kept together. And then somehow being accessed. So I agree with you. And I think Harold tried to make that point several times throughout the --

MEMBER CHU: Accumulation. That's quite different.

MEMBER RAY: Yes, I've mentioned to some offline here that I have experience discharging well within the limits and then having a concentrating mechanism downstream of the discharge point. And that concentrating mechanism happened to be kelp and the kelp came into the plant and it got in the dumpster and was quite radioactive. So it's that sort of thing that people don't think about that I've been looking for, not so much the lack of -- I got to find the right word here so it doesn't produce a reaction -- bounding analyses that are

done, but some overlook mechanism that could cause things to be different than what we expected them to be of the kind that I just mentioned. That was dealt with many years ago and it is not a problem I'm sure anywhere now today because people understand that that can happen. But here I don't see such a mechanism is available.

Anything else?

(No audible response.)

MEMBER RAY: Okay. Well, we do very much appreciate you guys getting us back closer to schedule. We've got two things left here to do today, and we'd ask everybody to stand by while we do that. One is we'll ask our -- any members of the public on the line who want to make comments to be able to do so. We're proceeding now to open the line, and while that's taking place I'll mention again that we don't take questions for answer. People can make comments in the form of a question, but don't expect us to respond to them. But we do very much solicit input from members of the public who may have been listening. After that's done, we'll ask members of the public --

And I'm -- you're most welcome and you're going to get your turn right after these

folks. And then we'll have any discussion among the members before we recess, not adjourn, but recess for the day.

Okay. The phone line is said to be open. If there's anyone who can hear my voice and is willing to do so, please at least indicate that you can hear me.

(No audible response.)

MEMBER RAY: So we're going to assume that that's an indication that there isn't anybody who wishes to respond to us, and we can therefore close the line.

Do you think, John, you're very --

CHAIRMAN STETKAR: If there's someone out there -- this is -- I'll make it simple. If there's someone out there, just please say hello.

PARTICIPANT: Hello.

CHAIRMAN STETKAR: Thank you.

PARTICIPANT: You're welcome.

PARTICIPANT: Hello.

CHAIRMAN STETKAR: One is good.

MEMBER RAY: But we do welcome comments from anybody on the phone line. If there is such, please speak up now because we'll turn the line off if not.

(No audible response.)

MEMBER RAY: All right. Well, thank you for being on the line. We have one, at least one member of the public here in the audience and we now welcome you to make your comments as you've seen done here before.

MR. STODDARD: Okay.

CHAIRMAN STETKAR: That should be on.

MR. STODDARD: Okay. The mic? No, it's not. It doesn't seem live. Is it live?

CHAIRMAN STETKAR: Yes, just tilt it up a little bit. It's not all that --

(Simultaneous speaking.)

PARTICIPANT: Just tap it.

MR. STODDARD: Okay. So I'm Phillip Stoddard. I'm a professor of biological sciences at FIU in Miami. I'm also a fourth term mayor, elected mayor of the City of South Miami. And I had a few things for you, just some comments on what I've heard today, and then something I'd like you to think about very carefully for tomorrow when you hear the testimony.

So I have read a paper in which partially treated sewage effluent was injected into the Boulder Zone and immediately afterwards ammonia

was detected in the upper Floridan.

By it's Floridan not Floridian. I'm a Floridian. For some reason we left the I out. It's the Floridan.

But ammonia apparently got through indicating there are at least some breaches in the middle confining unit, not necessarily at this site, but I just wanted you to be aware of that.

Another thing that is important, there was a question about whether any of this is drinking water. The upper Floridan is now being desalinated by Miami-Dade County for drinking water. We have run out of water from the Biscayne aquifer and we're starting to desalinate the Floridan.

Now six more inches of sea level rise is going to take -- is going to salinate the Biscayne aquifer. We're going to lose our surface aquifer as a drinking water supply forcing extensive desalinization and greater reliance on the Floridan. So expect that to come.

There was a comment on flow of the surface waters. Normally it is indeed towards the bay except at Turkey Point, and at Turkey Point it goes radially outwards in all directions because the hypersaline plume from the cooling canal sinks

downwards and goes outwards in all directions like an upside down mushroom.

But the other thing I wanted to talk to you about today is the sea level rise projections and the combined operating license application. It projects one foot of sea level rise by 2100. Now as you probably know, there's an executive order requiring all branches of the Federal Government to consider sea level rise in projections and planning. Data by the science -- the Rosenstiel School of Marine and Atmospheric Science show that Miami has already seen six inches of sea level rise since the COLA was written. Six inches. That's half of the projection up to 2100.

So the Corps of Engineers is projecting between three and nine inches of sea level rise by 2030; that's now 14 years out, 7 to 12 by 2040. So it's coming up on us. NOAA is now projecting as much as seven feet of sea level rise by the end of the century. So, and that doesn't include some of the unexpected de-stabilization of ice in Greenland and the Antarctic that's how forcing scientists to consider even greater scenarios that they haven't quite gotten their heads around yet.

So I think the NRC needs to consider

whether -- what would be the consequences of six or seven feet of sea level rise over the period where FPL has projected one foot. And I think there's multiple safety design issues at Turkey Point that are affected by these greater projections having to do with emergency access to the site, storm resistance, cooling water supply reliability and decommissioning access, because ultimately someone has to take this thing apart when we're done with it.

So I'd like you to consider whether the access roads to the facility and the water treatment plant also, which is part of the system, will remain accessible during storms and even at normal times with that kind of sea level rise. Will these roads be liable to wash after a storm surge? And I don't see any analysis in the COLA of road access when that part of the county is under six feet of water, or even four feet of water. It's a very low area.

Will storm surge dynamics be affected by this higher sea level rise? Elliott Key currently shields the Turkey Point site from the full effects of the Atlantic, but Elliott Key is going to be under water pretty soon. And so, there should be some change in the wave dynamics. I don't think

that has been modeled with a six or seven foot sea level rise scenario, just with a one foot sea level rise scenario.

What will happen to the cooling water supply from the south -- southern water treatment plant? The suburbs in that part of Miami-Dade County are going to get inundated and abandoned pretty quickly. And in fact the county water/sewer department is counting on that. That's the reason they decided not to upgrade the plants was because they thought they might in fact be abandoned. If that's the case, 60 days a year from the radial collector wells isn't going to be part of the scenario anymore. And I don't think that's been projected.

And ultimately the plant does need to be decommissioned. It's going to be an island sticking out of Biscayne Bay with no access to it. So what plans are in place for decommissioning when access has to be by barge instead of by road?

So the entire COLA was predicated on an negligible one foot of sea level rise over the century, and those were determined by retrospective analysis of sea level rise from the last century, not prospective modeling for the current century

based on climate models. That was an unrealistic projection when it was proposed. It's been proven wrong and nowhere in the COLA is a consideration of what safety design assumptions are vulnerable to far greater acceleration of the rates of sea level rise than one foot per century? And I think those formal considerations need to be made.

And I don't want to take up your time anymore today, but when you're listening tomorrow to the testimony, I'd like you to keep these questions in mind and determine whether we need to go -- "we," meaning somebody else other than me, I guess -- needs to go back and put those assumptions into the models to see what the implications are and whether the current projections and plans and designs are adequate. Okay? Thank you very much for your time.

MEMBER RAY: Well, thank you very much.

And I've got a request, or a question. You have obviously some notes that you used to ask these questions.

MR. STODDARD: Could I submit them to you in writing?

MEMBER RAY: This gentleman right here in the white shirt; his name is Peter Wen, he will give you his email address, and that's the quickest

way. You're on the transcript. We will have all that you've said available to us, but so that it's available most quickly, anything you have in --

MR. STODDARD: He will have it.

MEMBER RAY: -- the form of notes --

MR. STODDARD: Thank you.

MEMBER RAY: -- you send it to him.

MR. STODDARD: And thanks for giving me the opportunity.

MEMBER RAY: You bet. Thanks for coming.

Okay. Anyone else?

(No audible response.)

MEMBER RAY: All right. Then we'll see if there are any guidance/advice/comments relative to tomorrow's agenda, things that maybe you'd like to hear more about then that we've talked about today or just things that haven't even come up that you want to make sure we do hear about, please, anyone who would like to make a comment in that regard please do so.

(No audible response.)

MEMBER RAY: I see Mike's got his -- no, he doesn't have his microphone on. I thought it was.

Anybody?

(No audible response.)

MEMBER RAY: All right. It's 10 minutes after 5:00. I accept without asking for it all of your compliments about having gotten this done --

(Laughter.)

MEMBER RAY: -- only 10 minutes late.

PARTICIPANT: Well done, Harold.

MEMBER RAY: But thanks go to the applicant and the staff primarily.

CHAIRMAN STETKAR: You keep this up, I can cause unilaterally meetings to drag on. So just keep it up.

MEMBER RAY: All right. I'll stop. I'll stop.

Anyway, with that, we will be recessed until 8:30 tomorrow morning.

(Whereupon, the above-entitled matter went off the record at 5:10 p.m.)

1

2

3

Turkey Point Nuclear Power Plant

Units 6 & 7

Combined License Application

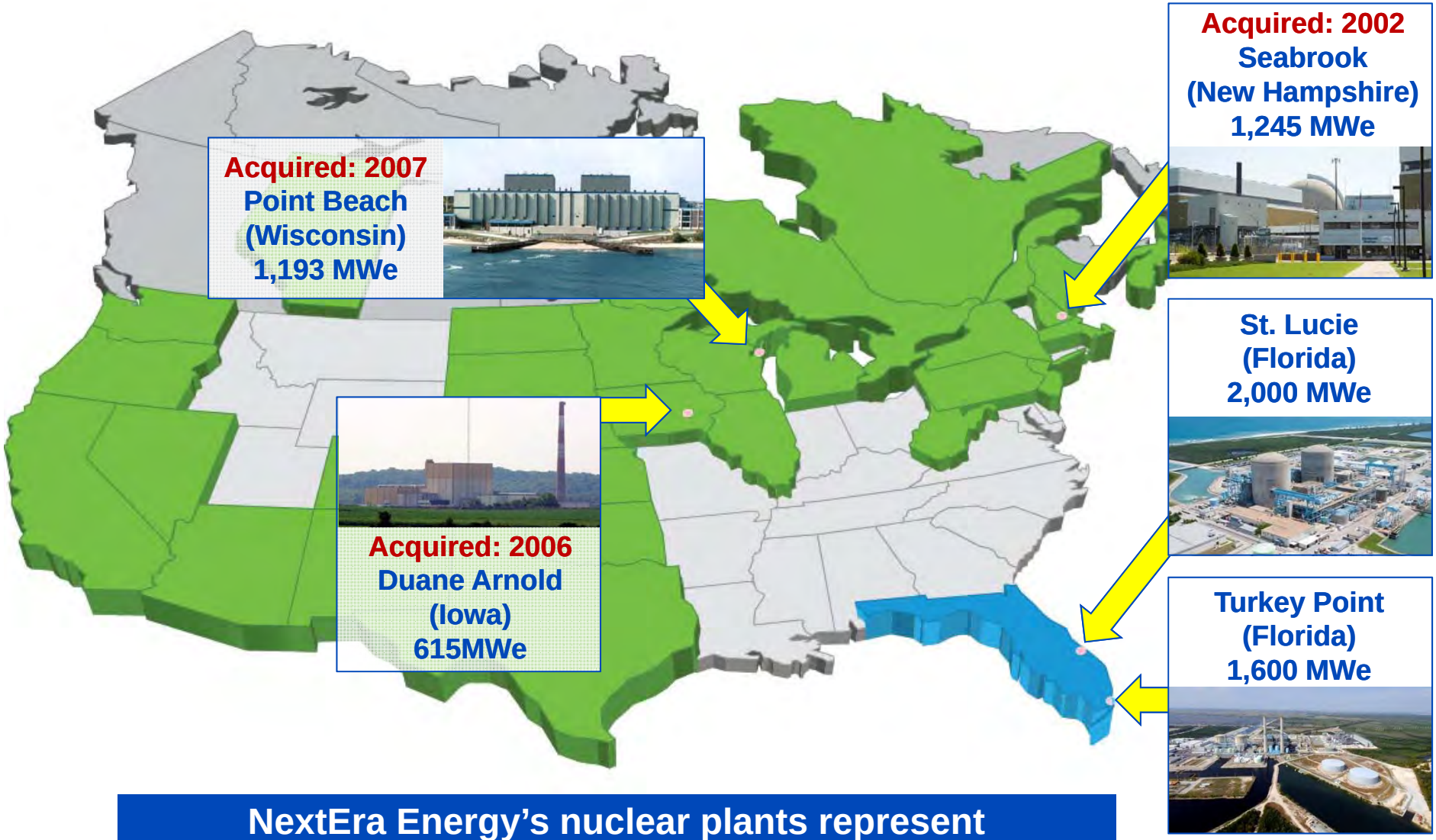
August 18, 2016

Turkey Point Nuclear Plant Units 6 & 7

Introduction

William Maher
Senior Licensing Director
New Nuclear Projects

NextEra Energy's nuclear fleet is 4th largest in MW capacity and number of reactors in the United States



NextEra Energy's nuclear plants represent approximately 24 percent of the company's generation

Turkey Point Nuclear Plant Units 6 & 7
Day 1

- Introduction
- Chap. 1 General Description of the Plant
- Chap. 2 Site Characteristics
- Section 2.1 Geography and Demography
- Section 2.2 Nearby Industrial, Transportation, & Military Facilities
- Section 2.3 Meteorology
- Section 2.4 Hydrologic Engineering
- Section 11.2 Liquid Waste Management System

Turkey Point Nuclear Plant Units 6 & 7
Day 2

- Section 2.5 Geology, Seismology, and Geotechnical Engineering
- Chap. 3 Design Of Structures, Components, Equipment and Systems
- Section 13.3 Emergency Planning
- Chap. 19 Probabilistic Risk Assessment
- Chap. 20 Requirements Resulting from Fukushima Near-Term Task Force Recommendations
- Chap. 21 Design Changes Proposed in Accordance with ISG-11

Turkey Point Nuclear Plant Units 6 & 7
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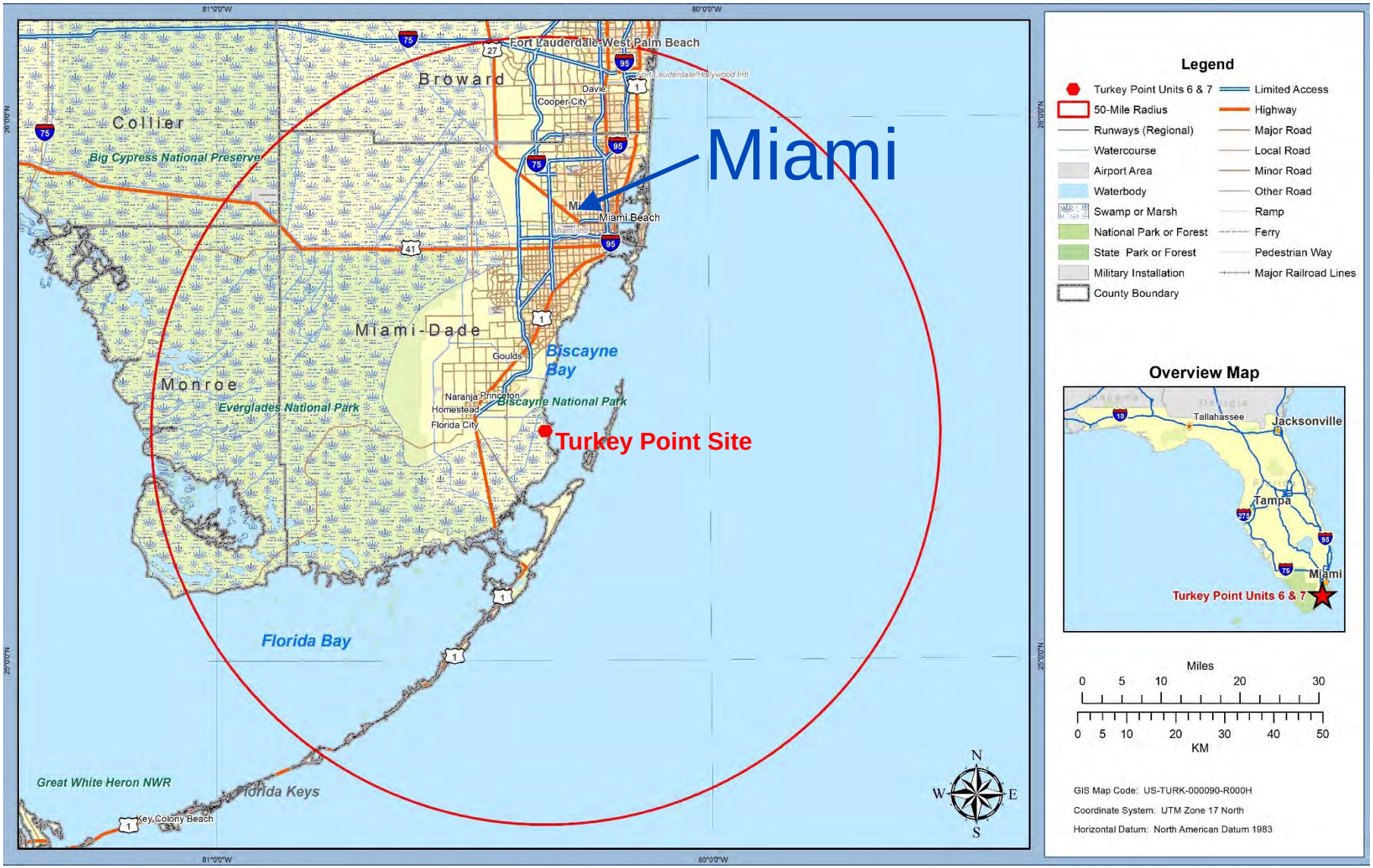
Turkey Point Nuclear Plant Units 6 & 7

Chap. 1 General Description of the Plant

Steve Franzone
Licensing Manager
New Nuclear Projects

Turkey Point Nuclear Plant Units 6 & 7

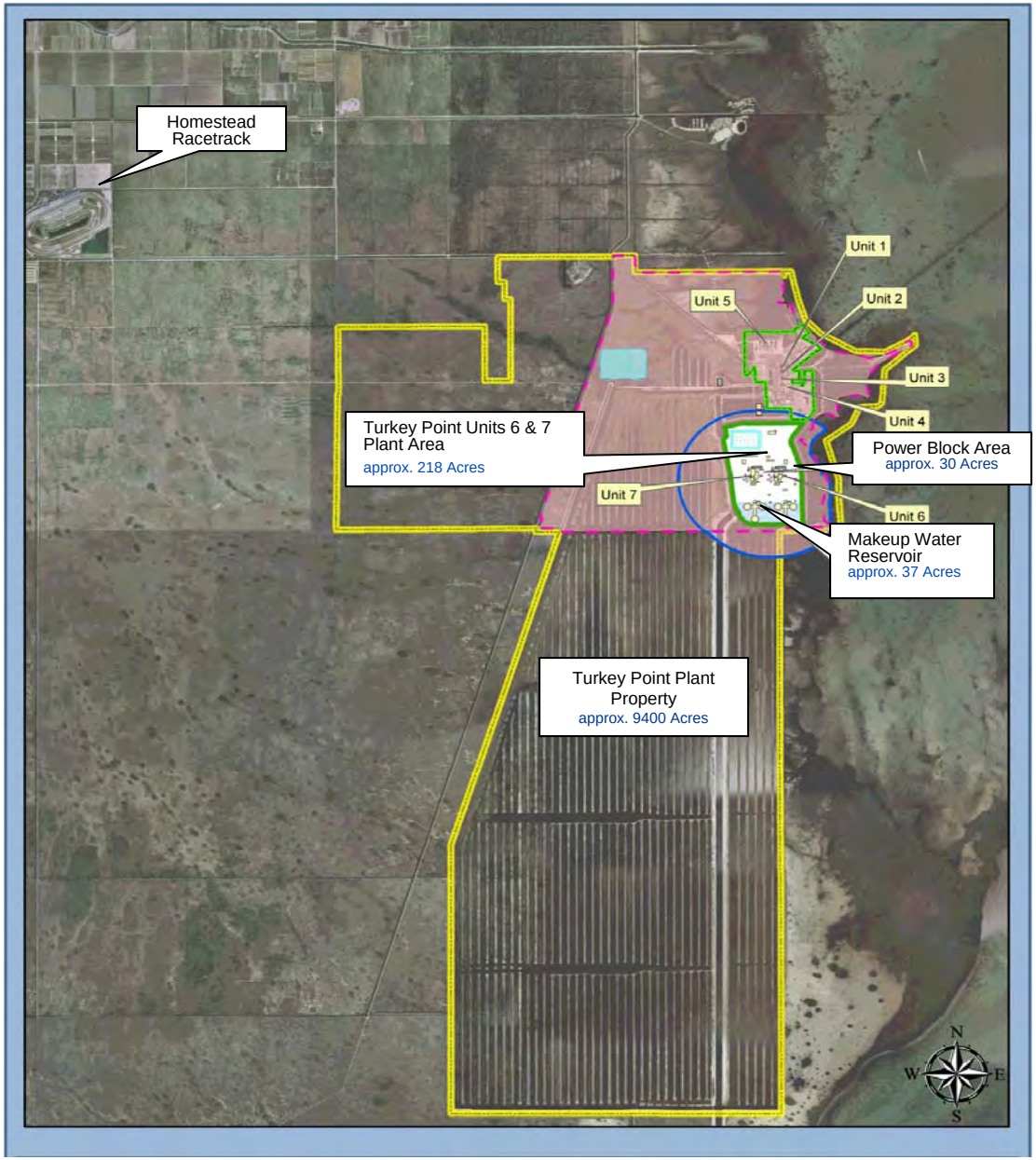


Source: FSAR Figure 2.1-201

Turkey Point Site Background

- 1965 – The site construction started with 2-400 MWe oil plants
- 1967 – Construction permit granted on April 27 for Turkey Point Nuclear (PTN) Units 3 & 4
- 1972 (Unit 3) – Commercial operation
- 1973 (Unit 4) – Commercial operation
- 2007 – Turkey Point Unit 5, a 1150 MWe combined-cycle gas-fired plant, goes into commercial operation
- 2009 – Submitted application for proposed PTN Units 6 & 7
- 2010 – Unit 2 retired
- 2013 – Completed power uprates to existing nuclear units
- 2016 – Unit 1 in process of being retired

Turkey Point Site Area



Turkey Point Nuclear Plant Units 6 & 7

Turkey Point Site Area

Source: FSAR Figure 2.2-201

Chapter 1 General Description of the Plant

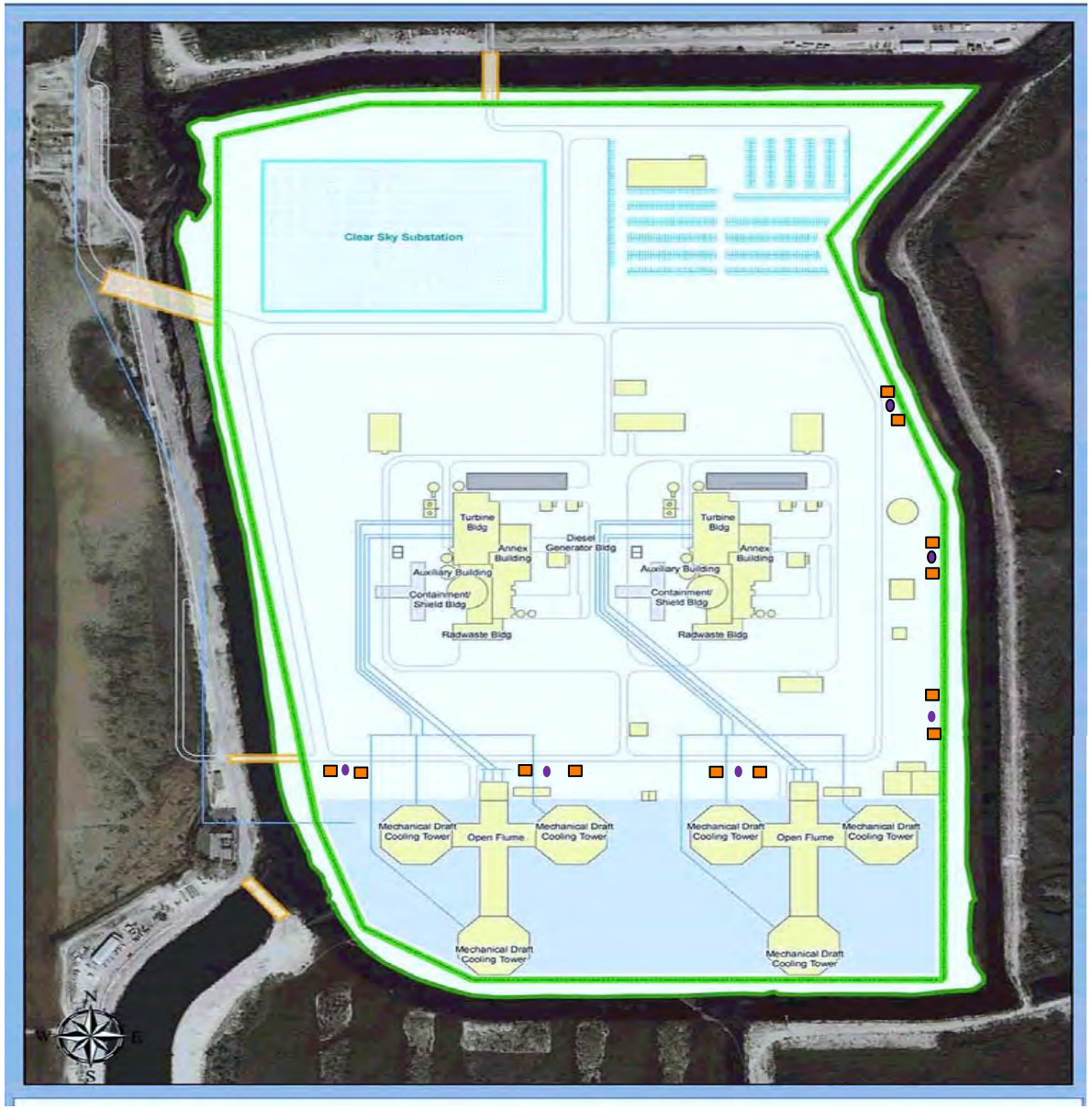
- **AP1000 DCD incorporated by reference**
- **Standard material incorporated (including supplements, departures and exemptions)**
- **Site-specific information**
  - Section 1.2: Units 6 & 7 Plant Layout
  - Section 1.4: Identification of Agents and Contractors
  - Section 1.8: Interfaces for Standard Design

Turkey Point Nuclear Plant Units 6 & 7

Turkey Point Units 6 & 7 Site

Turkey Point Nuclear Plant Units 6 & 7

Site Plot Plan



Turkey Point COLA Changes Since R-COL

- **Fukushima event**
- **Central & Eastern US Seismic Source Characterization sensitivity assessments**
- **Electrical Bulletin 2012-01 response**
- **AP1000 Generic Design Changes (reviewed on Levy docket)**
  - Condensate Return & Passive RHR Cooling
  - Main Control Room Operator Dose
  - Main Control Room Heat Load
  - Hydrogen Venting in Containment
  - Plant Monitoring System (PMS) Flux Doubling to comply with IEEE 603

Turkey Point Project - Challenges

- Postulated karst-related deformations
- Cuban seismic sources
- Address Regulatory Guide (RG) 1.221 (i.e., hurricane missiles)
- Use of Deep Well Injection System

Section 1.4 – Identification of Agents and Contractors

- **COLA Development**
  - Bechtel Power Corporation
- **AP1000 Standard Plant**
  - Westinghouse Electric Company LLC
- **Technical Services Supporting COLA Development**
  - Paul C. Rizzo Associates, Inc.
  - MACTEC Engineering and Consulting, Inc.
  - McNabb Hydrogeologic Consulting, Inc.
  - Fugro Consultants Inc.
  - AMEC Foster Wheeler (Environmental & Infrastructure, Inc.)
  - Golder Associates, Inc.
  - Risk Engineering, Inc.
  - William Lettis & Associates, Inc.
  - Tetra Tech NUS, Inc.
  - KLD Engineering, P.C.
  - ABS Consulting

Turkey Point Nuclear Plant Units 6 & 7
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- Section 2.3 Meteorology
- Section 2.4 Hydrologic Engineering
- Section 11.2 Liquid Waste Management System

Turkey Point Nuclear Plant Units 6 & 7

Chap. 2 Site Characteristics

Paul Jacobs
Engineering Supervisor
New Nuclear Projects

Section 2.0 – Site Characteristics

- **FSAR Table 2.0-201 provides comparison of the site-specific characteristics with the AP1000 site parameters in DCD Tier 2 Table 2-1**
- **All site-specific characteristics are bounded by the AP1000 site parameters, with the following exceptions:**
  - Air temperatures
  - Wind speed
  - Population distribution exclusion area

Turkey Point Nuclear Plant Units 6 & 7
Day 1

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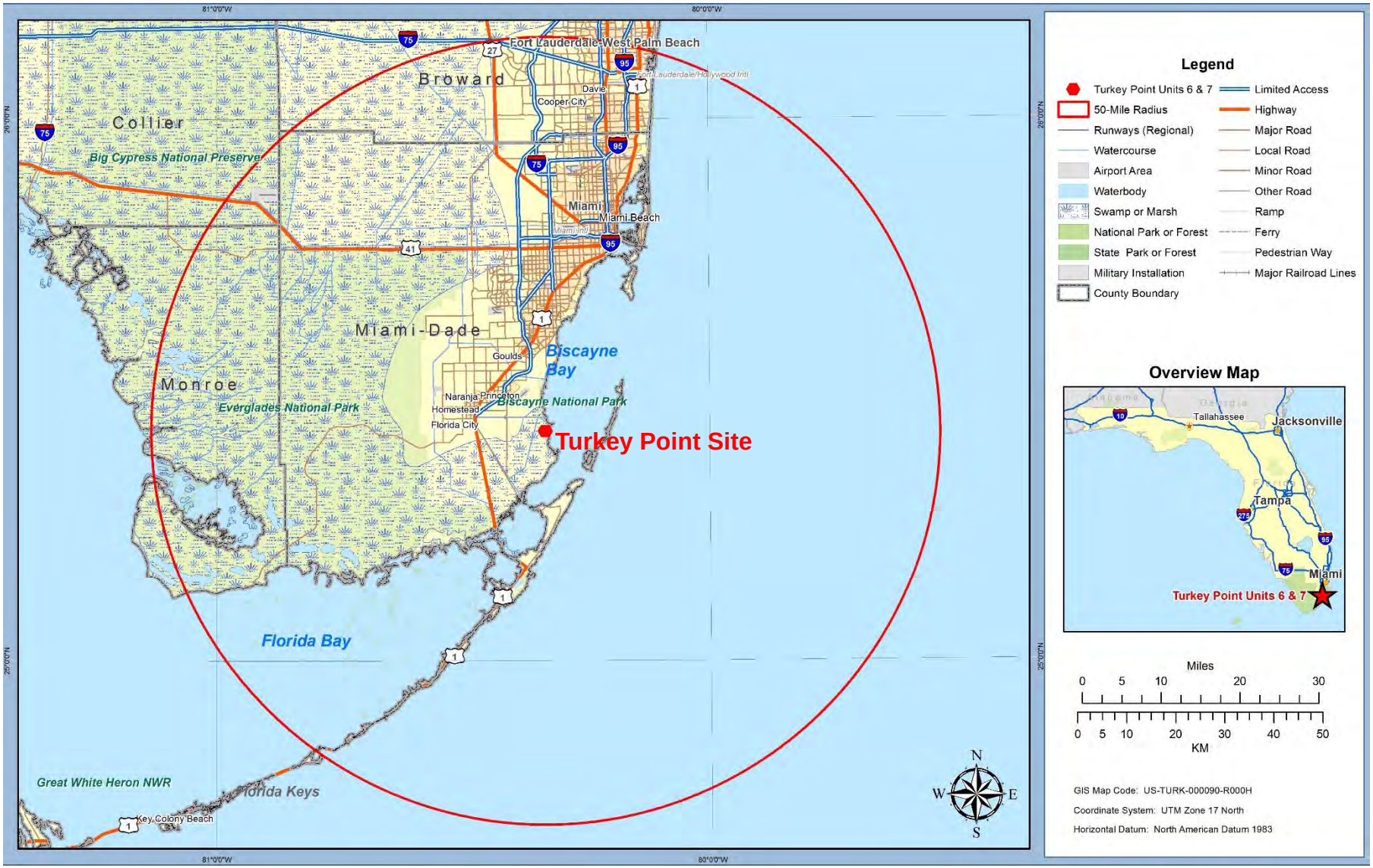
- Chap. 2 Site Characteristics
- **Section 2.1 Geography and Demography**
- Section 2.2 Nearby Industrial, Transportation, & Military Facilities
- Section 2.3 Meteorology
- Section 2.4 Hydrologic Engineering
- Section 11.2 Liquid Waste Management System

Section 2.1 – Geography and Demography

COL Information Item, PTN COL 2.1-1:

- **Site Information-Location and Description**
  - Miami Dade County, Florida
    - 25 miles south of Miami
  - Prominent natural features
    - Biscayne Bay
    - Everglades National Park
  - Closest municipalities
    - Homestead
    - Islandia
    - Florida City

Turkey Point Nuclear Plant Units 6 & 7



Source: FSAR Figure 2.1-201

Section 2.1 – Geography and Demography

COL Information Item, PTN COL 2.1-1:

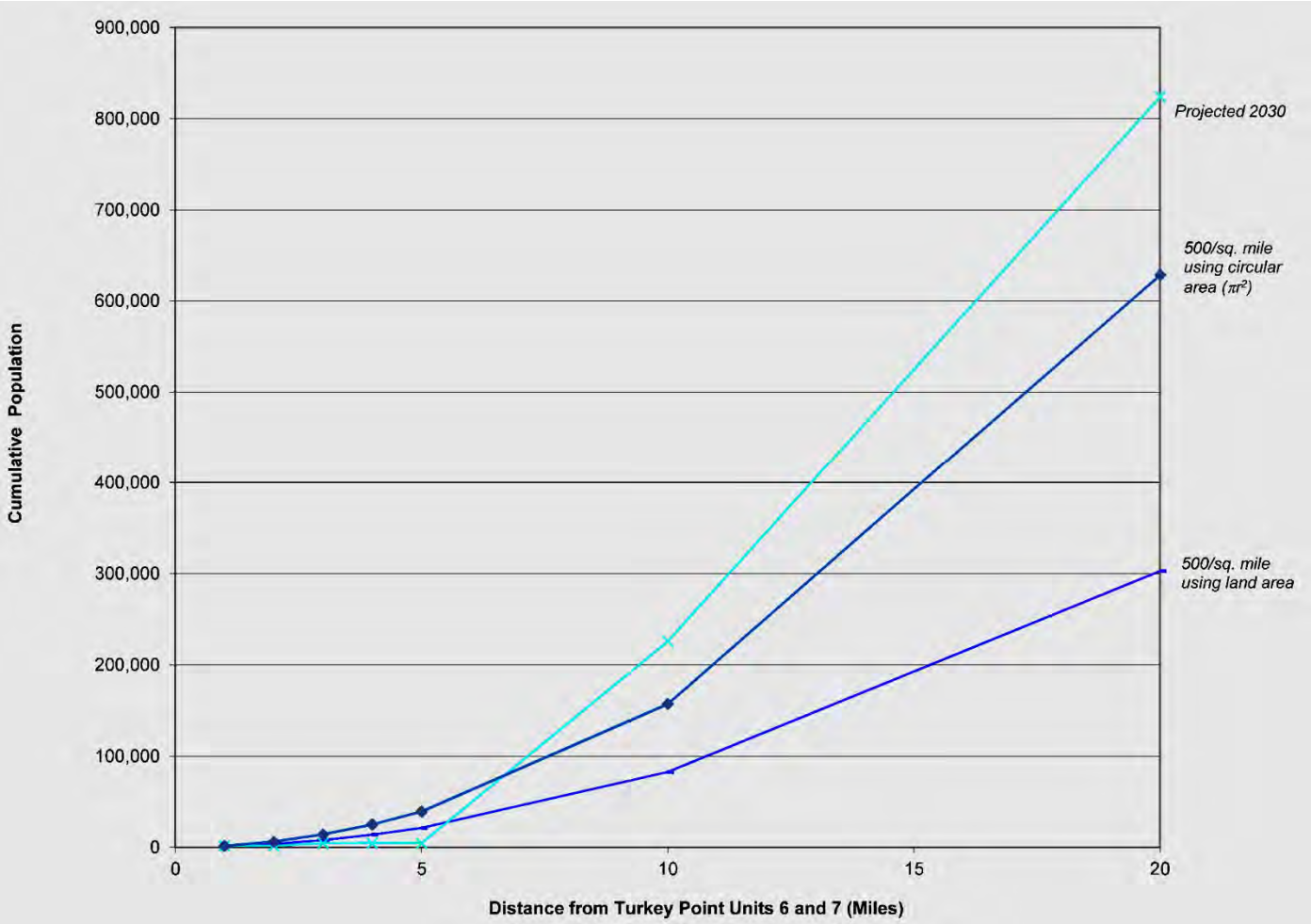
- **Population**
  - Closest population center (10 CFR 100.3)
    - -- Homestead – population 60,512
  - Meets requirement of 10 CFR 100.21(b)
    - -- Distance between municipal limits of Homestead and site boundary is approximately 4.5 miles
    - -- Distance to boundary of population center is 1.6 times radius of the 5-mile LPZ centered on Units 3 & 4
    - -- Requirement that population center distance is at least one and one-third times distance from Units 6 & 7 reactors to outer boundary of LPZ is met

Population center distance criterion (10 CFR 100.21(b)) met.

Turkey Point Nuclear Plant Units 6 & 7

Section 2.1 – Geography and Demography

Population Compared to NRC Siting Criteria



Source: FSAR Figure 2.1-227

Section 2.1 – Geography and Demography

- **Population (continued)**
  - Population density per Regulatory Guide 4.7
    - 2030 population, based on 2010 census block date, is greater than 500 person-per-square-mile density criterion using both land area and circular area calculation methods
    - Projected 2030 population at 10- and 20-mile radii also exceed criterion calculated for both land area and circular area
  - While Regulatory Guide 4.7 population density criterion is not met, related safety factors were considered:
    - Radiation dose requirements in 10 CFR 52.79(a)(1)(vi) to public are met
    - Emergency Plan and associated Evacuation Time Estimate account for consequences of radiological emergencies required by 10 CFR 50.47 and 10 CFR 50, Appendix E
  - As stated in Regulatory Guide 4.7 and 10 CFR 100.21(h), in determining acceptability of a site located away from a very densely populated center but not in an area of low density, consideration should be given to safety, environmental, economic, or other factors
    - Alternative site analysis presented unique safety, economic, reliability, and environmental attributes that would not be realized if the plant were developed elsewhere
    - Analysis concluded no alternative site was environmentally preferable

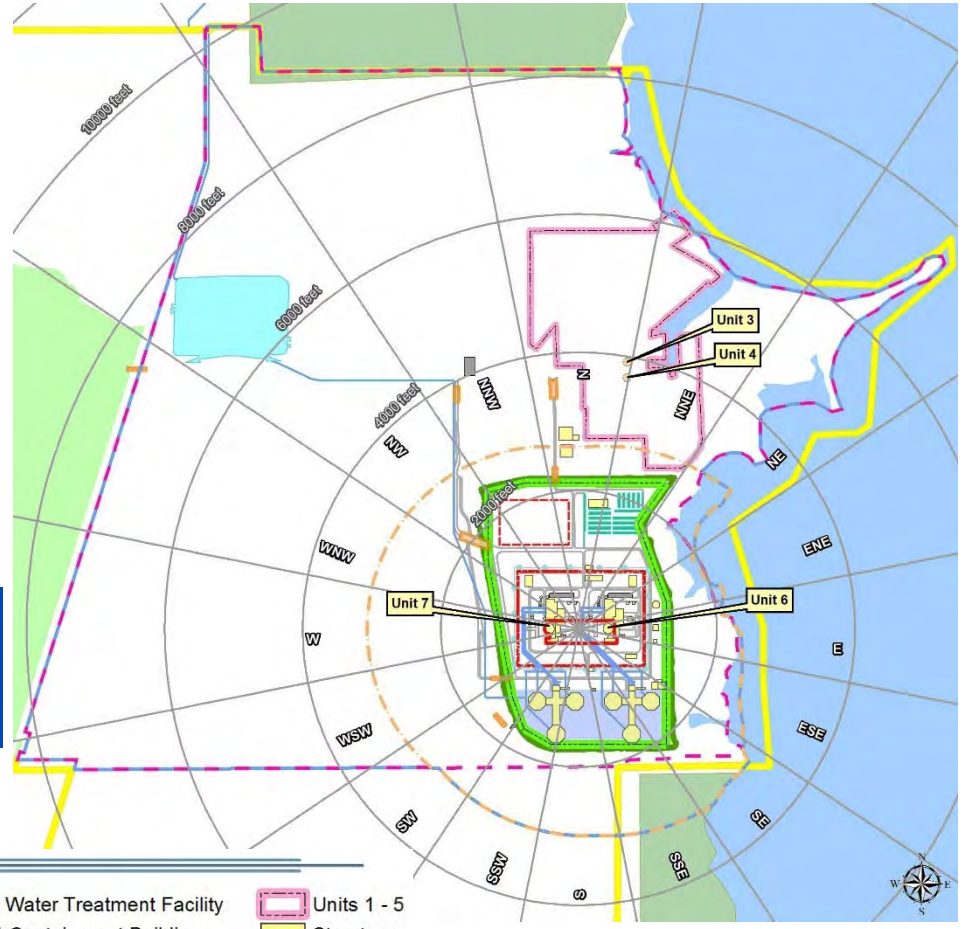
Turkey Point Nuclear Plant Units 6 & 7

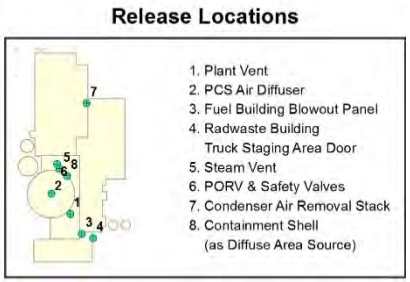
Section 2.1 – Geography and Demography

COL Information Item, PTN COL 2.1-1:

- **Exclusion Area Boundary**
  - EAB for Units 6 & 7 primarily lies within EAB for Units 3 & 4 with exception of eastern and southern portions
  - Combined EAB provides a minimum distance of 1427 feet from Units 6 & 7 source boundary (PTN DEP 2.0-4)

PTN DEP 2.0-4 Evaluation: Site characteristic X/Qs at EAB meet DCD parameter value.





Plant Wall Line
Water Line
Fence Line
Combined EAB
Turkey Point Plant Property
Reclaimed Water Treatment Facility
Units 3 & 4 Containment Buildings
Units 6 & 7 EAB
Units 3 & 4 EAB
Source Boundary
Substation Transformer
Units 1 - 5
Structure
Bridge
Slab

Source: FSAR Figure 2.1-204

Turkey Point Nuclear Plant Units 6 & 7
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- Section 2.3 Meteorology
- Section 2.4 Hydrologic Engineering
- Section 11.2 Liquid Waste Management System

Section 2.2 – Nearby Industrial, Transportation, & Military Facilities

COL Information Item, PTN COL 2.2-1:

- **Evaluation of Potential Accidents**
  - Nearby Industrial, Transportation and Military Facilities
    - -- Industrial/Military
      - – Turkey Point Units 1 through 5
      - – Homestead Air Reserve Base
    - -- Transportation
      - – Onsite Transportation Routes
      - – Miami to Key West Florida Intracoastal Waterway
      - – Florida Gas Transmission Company's Turkey Point Lateral Pipeline and Homestead Lateral Pipeline
      - – Airport and Airway Routes
        - » Homestead Air Reserve Base
        - » Airway V-3

Turkey Point Nuclear Plant Units 6 & 7

Section 2.2 – Nearby Industrial, Transportation, & Military Facilities

Source: FSAR Figure 2.2-201

Section 2.2 – Nearby Industrial, Transportation, & Military Facilities

- **Evaluation of Potential Accidents (continued)**
  - Hazard Evaluations (Site-Specific Chemicals)
    - -- Explosions/Boiling Liquid Expanding Vapor Explosion (BLEVE)
      - – Analyses demonstrated a peak positive overpressure of 1 psi, or a thermal heat flux of 5KW/m^2 from a BLEVE, will not be exceeded at any safety-related structure
    - -- Flammable/Explosive Vapor Cloud (Delayed Ignition)/Jet Fire/Heat Flux
      - – Analyses demonstrate that ignition of a flammable/explosive vapor cloud involving the identified chemicals, or a jet fire from the pipeline, would not affect safe operation of Turkey Point Units 6 & 7
    - -- Toxic Chemicals
      - – Each toxic chemical evaluated was below the Immediately Dangerous to Life or Health (IDLH) limit prior to reaching the control room air intake with the exception of chlorine and sodium hypochlorite
        - » The concentration of both chlorine and sodium hypochlorite were below the IDLH limit inside the control room
      - – Analyses demonstrate that a toxic vapor cloud involving the identified chemicals would not affect safe operation of Turkey Point Units 6 & 7

Section 2.2 – Nearby Industrial, Transportation, & Military Facilities

- **Evaluation of Potential Accidents (continued)**
  - Hazard Evaluations (AP1000 Standard Chemicals)
    - -- Hazards associated with AP1000 standard chemicals are addressed in DCD Table 2.2-1 (explosion and flammable vapor cloud safe distances) and FSAR Table 6.4-201 (toxicity)
    - -- Storage of identified AP1000 standard chemicals meet safe distance requirements
- **Review of Aircraft/Airway Hazards**
  - Evaluation performed using guidance and methodology specified in SRP 3.5.1.6 and DOE-STD-3014-96
    - -- Total impact frequency from airport operations: 2.56E-07/year
    - -- Total impact frequency from non-airport operations: 3.61E-06/year
    - -- Total impact frequency: 3.86E-06/year
      - – Dominated by general aviation operations
      - – Greater than an order of magnitude of 1E-07/year (SRP 3.5.1.6 criteria)
      - – Evaluation against second criterion (core damage frequency, CDF, less than 1E-08/year) was performed
        - » Evaluation presented in FSAR Section 19.58

Turkey Point Nuclear Plant Units 6 & 7
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Section 2.3 – Meteorology

COL Information Item, PTN COL 2.3-1 Regional Climatology:

- **Units 6 & 7 site is a relatively flat site located on the lower east coast of Florida within the Atlantic Coastal Ridge**
- **General climate is classified as subtropical maritime (humid subtropical)**
- **Region is subject to sea/land breeze circulations**

Turkey Point Nuclear Plant Units 6 & 7

Section 2.3 – Meteorology

AP1000 Site Parameters Related to Regional Climatology

Design Parameter		Tier 1	Tier 2	Site-Specific Characteristic
Air Temperature				
Maximum Safety	115°F dry bulb/86.1°F coincident wet bulb	√	√	103.0°F/75.2°F (100-year return period)
	86.1°F wet bulb (noncoincident)	√	√	87.4°F
Minimum Safety	-40°F	√	√	17.9°F
Maximum Normal	101°F dry bulb/80.1°F coincident wet bulb		√	91.3°F/79.3°F
	80.1°F wet bulb (noncoincident)		√	81.5°F
Minimum Normal	-10°F		√	46.9°F
Wind Speed/Tornado				
Operating Basis	145 mph (3 second gust); importance factor 1.15 (safety), 1.0 (nonsafety); exposure C; topographic factor 1.0		√	150 mph
Tornado	Maximum wind speed of 300 mph	√	√	200 mph
	Maximum pressure differential of 2.0 lb/in^2	√		0.9 lb/in^2

Section 2.3 – Meteorology

Regional Climatology (continued)

Site-specific characteristics are bounded by AP1000 site parameters except for maximum safety and normal wet-bulb (noncoincident) air temperature and basic wind speed

- **Maximum Safety Wet Bulb (noncoincident) is approximately 87.4°F (PTN DEP 2.0-3)**
  - Exceeds the AP1000 DCD Tier 1 and 2 design value of 86.1°F
  - Effect of site-specific maximum safety wet bulb (noncoincident) air temperature of 87.4°F evaluated
- **Maximum Normal Wet Bulb (noncoincident) is approximately 81.5°F (PTN DEP 2.0-2)**
  - Exceeds the AP1000 DCD Tier 2 design value of 80.1°F
  - Effect of site-specific maximum normal wet bulb temperature of 81.5°F (noncoincident) evaluated

PTN DEP 2.0-2 and 2.0-3 temperature evaluations: Site-specific values do not affect any SSC design function or analysis methods as presented in DCD.

Section 2.3 – Meteorology

Regional Climatology (continued)

- **"Basic" wind speed is approximately 150 mph (PTN DEP 2.0-1)**
  - 150 mph 3-second gust is associated with a 50-year recurrence interval
  - Estimated from plot of basic wind speeds in Figure 6-1B of ASCE 7-05
  - Exceeds the AP1000 DCD Tier 2 design value of 145 mph (3 second gust)
  - Wind load does not control design for Nuclear Island structures
    - -- Auxiliary Building wall and roof structure design is controlled by tornado, seismic, and accident pressure/temperature
    - -- Shield Building design is controlled by seismic loads

PTN DEP 2.0-1 wind speed evaluation: Increase in wind design speed will not impact AP1000 design.

- **Other SRP considerations:**
  - 3-second gust wind speed for 100-year return interval is 161 mph (150 mph times scaling factor, 1.07)
  - Nominal 3-second gust that can be expected to occur with a return period of 1E07 years is 260 mph (Figure 1 of Regulatory Guide 1.221)

Section 2.3 – Meteorology

COL Information Item, PTN COL 2.3-2 Local Meteorology:

- **The annual wind direction distribution at the 10-meter level generally follows an easterly orientation on an annual basis**
  - Winds from east direction predominate during spring, summer and autumn months
  - During winter, relative frequency of north-northwest winds is greater
- **On annual basis, mean wind speeds at 10- and 60-meter levels are 3.8 and 5.6 meters/second, respectively**
  - Only few calm winds recorded by meteorological monitoring system at 10- and 60-meter levels
- **Data indicates:**
  - Predominance of neutral stability (Class D) and slightly stable (Class E) conditions throughout the year, 28.5 percent and 36.5 percent, respectively
  - Extremely stable conditions (Class G) most frequent during winter (approximately 10.3 percent) and less frequent during summer (approximately 1.7 percent)

Section 2.3 – Meteorology

COL Information Item, PTN COL 2.3-3 Onsite Meteorological Measurements Program:

- **Meteorological monitoring program is comprised of a set of towers and associated systems and consists of two phases:**
  - Preoperational monitoring—Data from existing Units 3 & 4 meteorological stations during 2002, 2005, and 2006 establish baseline. Period of data is:
    - Best available (using validated data with least data substitution)
    - Representative (tower and sensor siting in accordance with RG 1.23, Revision 1)
    - Complete (with annualized composite data recovery of 90 percent), without being older than 10 years
  - Operational monitoring—same preoperational set of existing meteorological stations is used for operational phase for Units 6 & 7

Section 2.3 – Meteorology

COL Information Item, PTN COL 2.3-4 Short-Term Diffusion Estimates:

- **NRC-sponsored PAVAN computer code used to estimate relative ground-level atmospheric concentrations (X/Q) at EAB and LPZ for potential accidental releases of radioactive material**
  - Effects of airflow recirculation from Biscayne Bay on dispersion environment were accounted for in annual average calculations as indicated in RG 1.111
  - Results demonstrate X/Q values determined by PAVAN modeling analyses at EAB and LPZ do not exceed corresponding AP1000 DCD Tier 1 and 2 site parameter design values
- **NRC-sponsored ARCON96 model used to estimate control room X/Qs for potential accidental releases of radioactive material**
  - Estimated at control room HVAC intake and annex building access door receptors from eight release sources
  - Results demonstrate the X/Qs determined by ARCON96 modeling analyses at control room air intake and annex building access door for reactor building plant stack releases are bounded by corresponding AP1000 DCD Tier 1 and Tier 2 site parameter design values

Site specific short-term X/Qs meet AP1000 site parameter design values.

Section 2.3 – Meteorology

COL Information Item, PTN COL 2.3-5 Long-Term Diffusion Estimates:

- **NRC-sponsored XOQDOQ computer code used to estimate X/Q and D/Q values for continuous releases of gaseous effluents to the atmosphere**
  - X/Q and D/Q values calculated at receptors of interest—EAB, nearest resident, nearest vegetable garden, nearest milk animal, and nearest meat animal
  - To account for possible land-water recirculation effects from Biscayne Bay on the local meteorological conditions, default correction factors implemented

Calculated doses at receptors of interest are below 10 CFR 50, Appendix I design objectives.

Turkey Point Nuclear Plant Units 6 & 7
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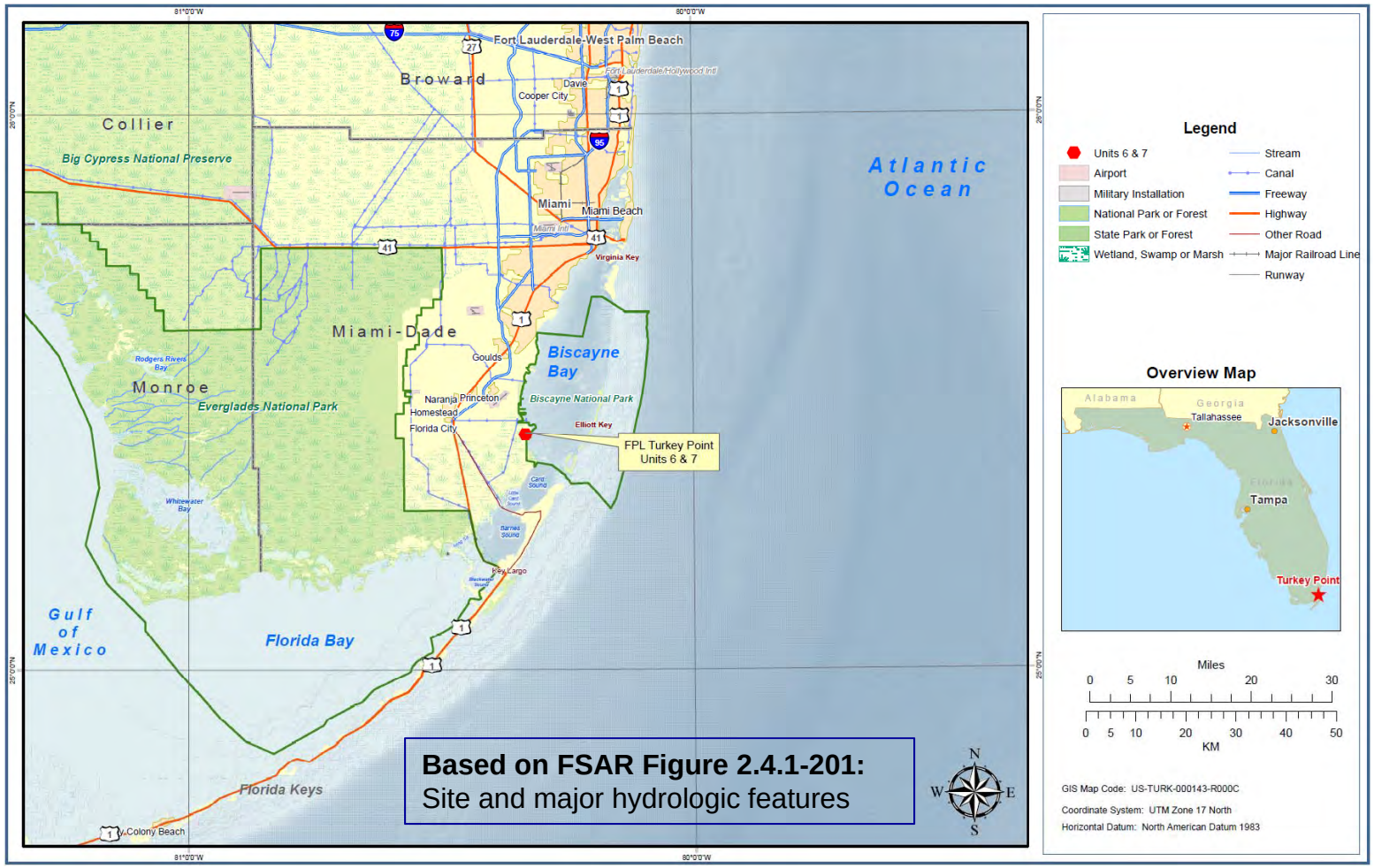
- Section 11.2 Liquid Waste Management System

Section 2.4 – Hydrologic Engineering

- **Review of each Sub-section:**
  - 2.4.1 Hydrologic Description
  - 2.4.2 Floods
  - 2.4.3 Probable Maximum Flood on Streams and Rivers
  - 2.4.4 Potential Dam Failures
  - 2.4.5 Probable Maximum Surge and Seiche Flooding
  - 2.4.6 Probable Maximum Tsunami Hazards
  - 2.4.7 Ice Effects
  - 2.4.8 Cooling Water Canals and Reservoirs
  - 2.4.9 Channel Diversions
  - 2.4.10 Flooding Protection Requirements
  - 2.4.11 Low Water Considerations
  - 2.4.12 Groundwater
  - 2.4.13 Accidental Releases of Radioactive Liquid Effluents in Ground and Surface Waters

Turkey Point Nuclear Plant Units 6 & 7

Subsection 2.4.1: Hydrologic Description

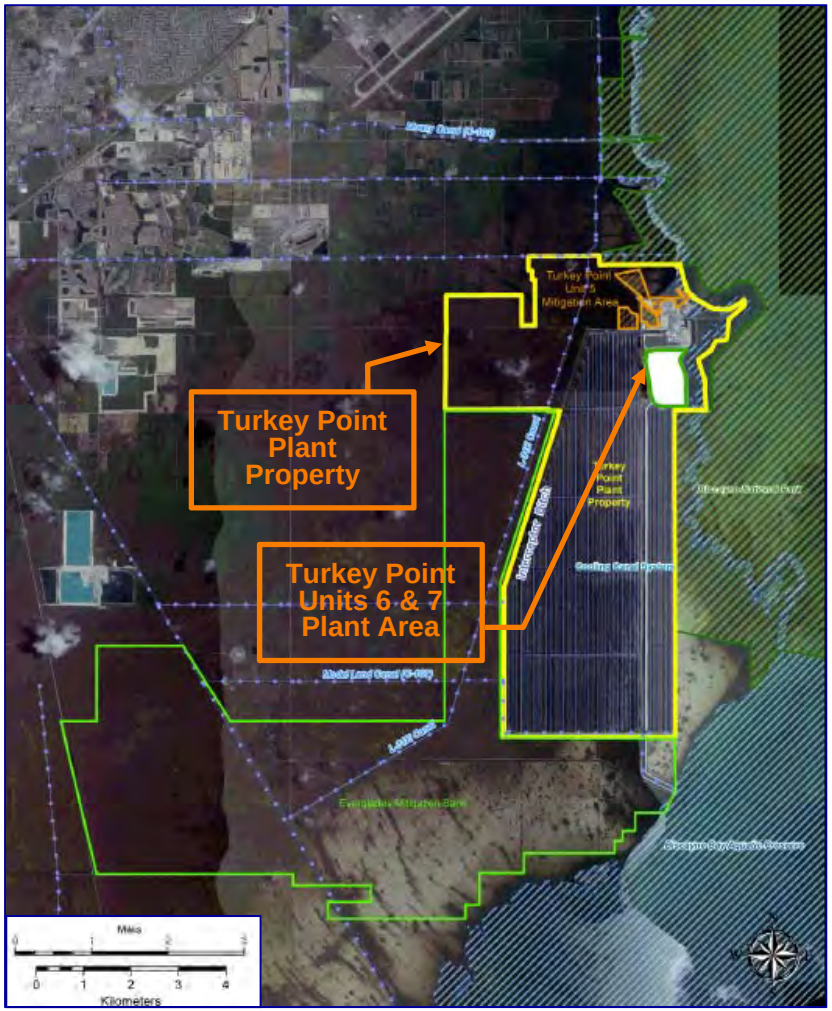


Units 6 & 7 to be located on the Biscayne Bay shore about 8 miles west of the Elliott Key barrier island that separates the bay from the Atlantic Ocean

Turkey Point Nuclear Plant Units 6 & 7

Subsection 2.4.1: Hydrologic Description

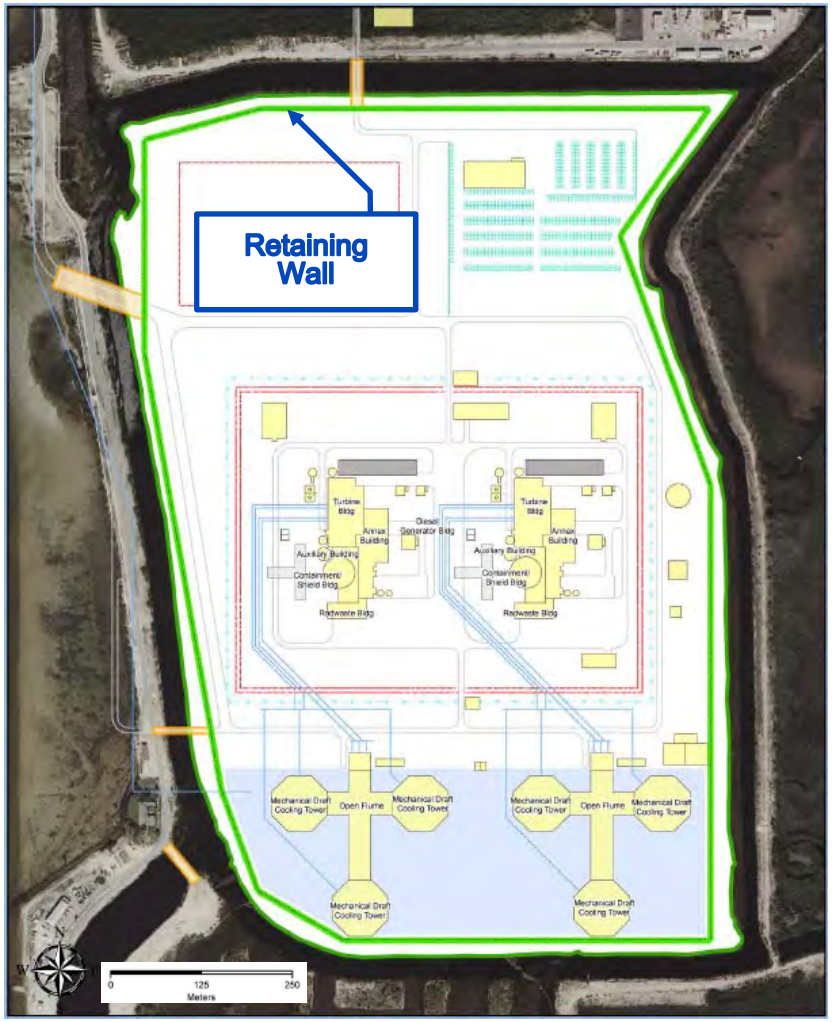
- **No surface water bodies are to be used as a water supply source, effluent discharge point, or heat sink**



Based on FSAR Figure 2.4.1-203:
Site and cooling canal system

Subsection 2.4.1: Hydrologic Description

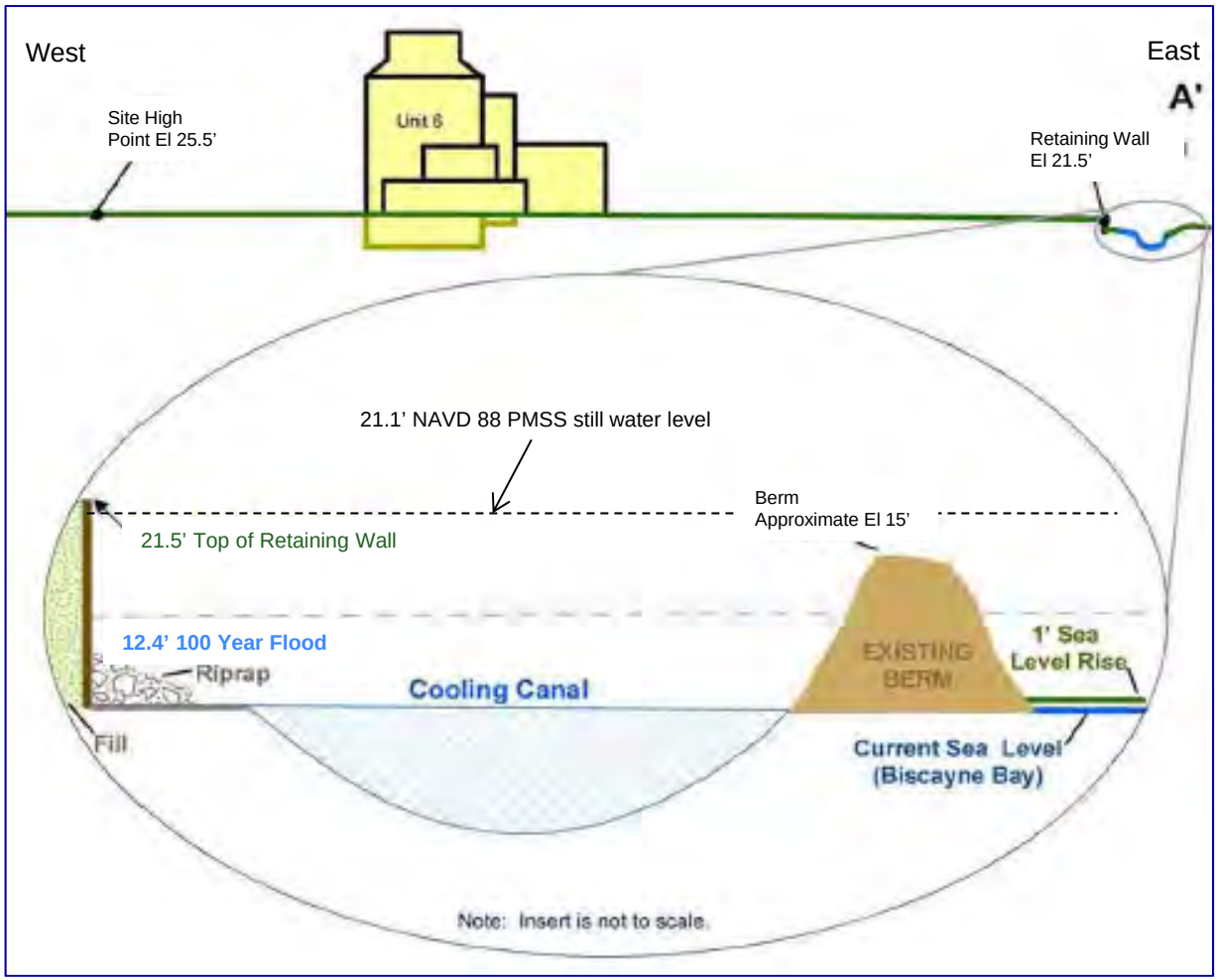
- Site elevation to be raised, protected by a retaining wall
- Site grade ranges between El. 19.0 feet NAVD 88 at the retaining wall and 25.5 feet NAVD 88 at the highest elevation
- DCD Plant elevation El. 100 feet corresponds to the plant design grade elevation at 26.0 feet NAVD 88



Based on FSAR Figure 2.4.1-204:
Site general arrangement

Turkey Point Nuclear Plant Units 6 & 7

Subsection 2.4.1: Hydrologic Description



Based on FSAR Figure 2.5.4-221: Profile of site grading

Turkey Point Nuclear Plant Units 6 & 7

Subsection 2.4.2: Floods

Design Grade and Flood Events	Elevation (feet NAVD 88)
Plant Design Grade Elevation	26.0
Local Intense Precipitation Flooding	24.5
Probable Maximum Storm Surge Flooding (Design Basis Flood elevation)	**24.8**
Probable Maximum Tsunami Flooding	14.0
Maximum Observed Water Level in Biscayne Bay (from Hurricane Andrew, 1992)	15.37

AP1000 DCD criterion met for design basis flood elevation.

Subsection 2.4.2.3: Effects of Local Intense Precipitation

- Local probable maximum precipitation (local PMP) depths are obtained from National Oceanic and Atmospheric Administration Hydrometeorological Reports 51 and 52
- 1-hour point (1-mi^2) rainfall depth is obtained as 19.4 inches

AP1000 DCD criterion met for one-hour one-mi^2 rainfall intensity.

- During local PMP, site grade would allow runoff to drain away from safety-related structures as sheet flows and overland flows
- Assumed all underground normal stormwater drainage features completely blocked
- The maximum local PMP flood elevation obtained is 24.5 feet NAVD 88, which is below the plant design grade elevation of 26.0 feet NAVD 88

Subsection 2.4.5: Probable Maximum Surge and Seiche Flooding

- **The Atlantic Ocean is the source of hurricane storm surges near the site where the storm surge generated by the probable maximum hurricane (PMH) would propagate through the bay to affect the site**
- **PMH parameters obtained from the National Oceanic and Atmospheric Administration (NOAA) are applied to compute storm surge elevation at the site**
- **Antecedent water level, which is used as the initial water level in the computation, is 3.6 feet NAVD 88 including:**
  - 10% exceedance high spring tide and initial rise (from RG 1.59): 2.6 feet NAVD 88
  - Long-term sea level rise (60 years): 1.0 foot
- **The computed 10-minute average PMH maximum wind speed is 159 miles/hour, coincidental wave height is 15.4 feet and period is 5.1sec.**
- **The Probable Maximum Storm Surge is obtained as 24.8 feet NAVD 88 including:**
  - Probable maximum surge: 21.1 feet NAVD 88
  - Wave runup: 3.7 feet
- **No seiche impacts from Biscayne Bay or makeup water reservoir**

Subsection 2.4.6: Probable Maximum Tsunami Hazards

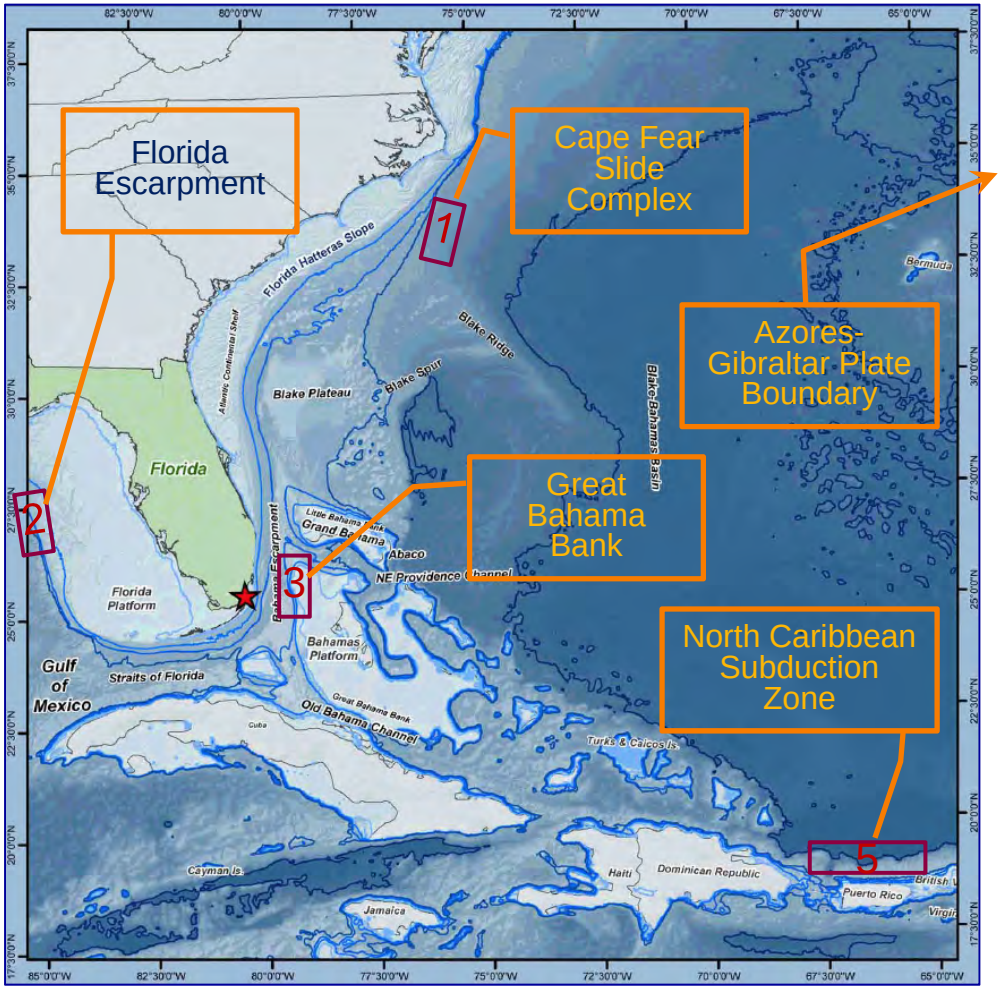
Potential PMT Sources

- **Submarine Landslide Sources**
  1. Cape Fear Slide Complex
  2. Florida Escarpment
  3. Great Bahama Bank

  – Tsunami elevation of 13.5 feet NAVD 88 from the Great Bahama Bank

- **Earthquake Sources**
  4. Azores-Gibraltar Plate Boundary
  5. North Caribbean Subduction Zone

  – Probable maximum tsunami elevation of 14.0 feet NAVD 88 from the Azores-Gibraltar earthquake source



Based on FSAR Figure 2.4.6-209:
Geophysical setting and seafloor topography

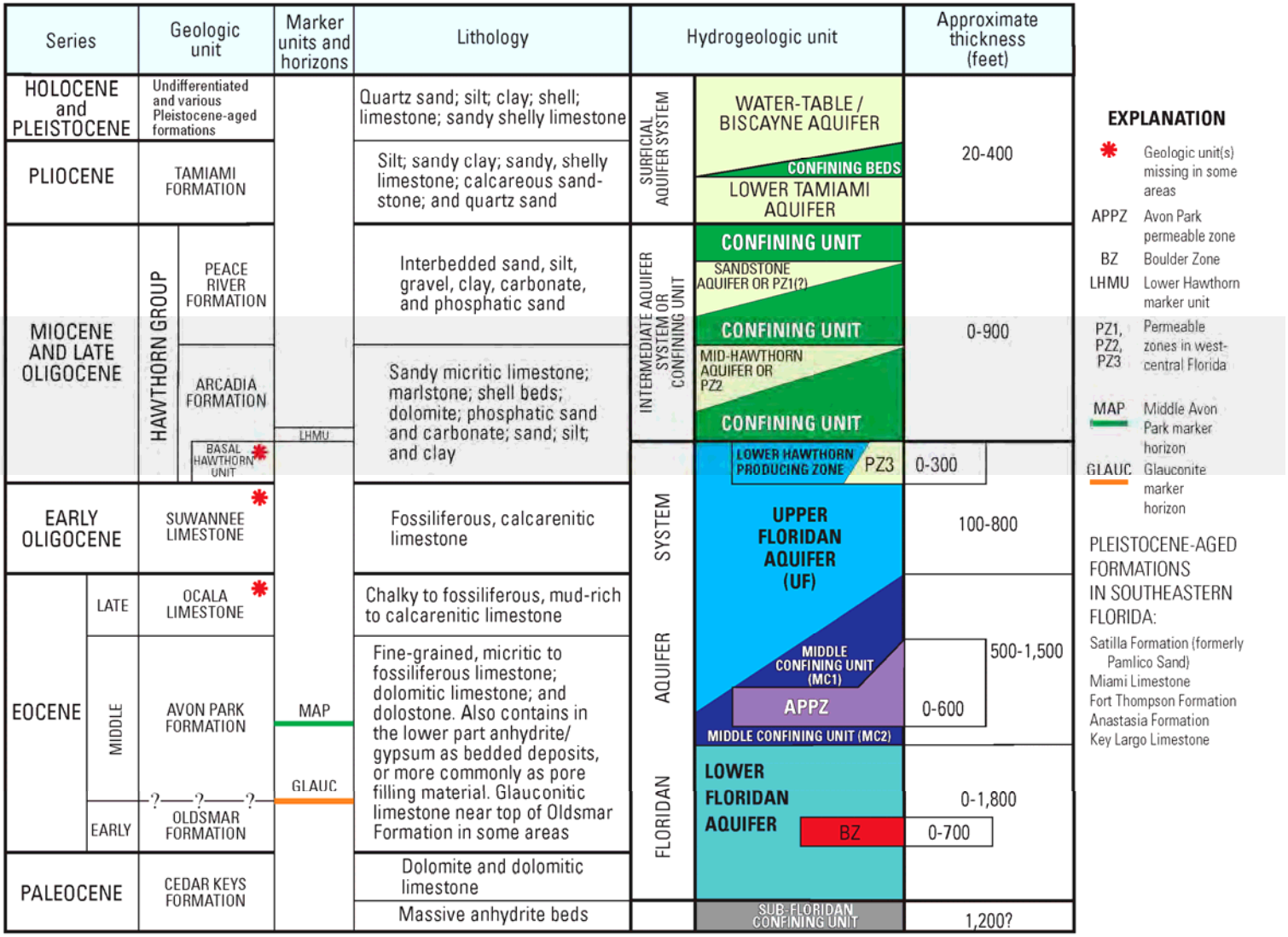
Subsection 2.4.12: Groundwater

Topics

- Hydrostratigraphic framework
- Maximum groundwater level
- Radial collector well operation
- Wastewater disposal (discussed in Section 11.2)

Turkey Point Nuclear Plant Units 6 & 7

Subsection 2.4.12: Groundwater



Regional Generalized Hydrostratigraphic Column
(FSAR Figure 2.4.12-202 [Source Reference 206])

Subsection 2.4.12: Groundwater

Surficial Aquifer System

- Biscayne aquifer and Tamiami formation
- Undifferentiated sand, silt and clay, shell, and shelly limestone (220 ft thick at site)
- Saline water quality in vicinity of site (unsuitable for potable water supply)

Intermediate Confining Unit

- Hawthorn group
- Relatively impermeable clayey deposits (700-1,000 ft thick at site)

Floridan Aquifer System (interbedded carbonate rocks)

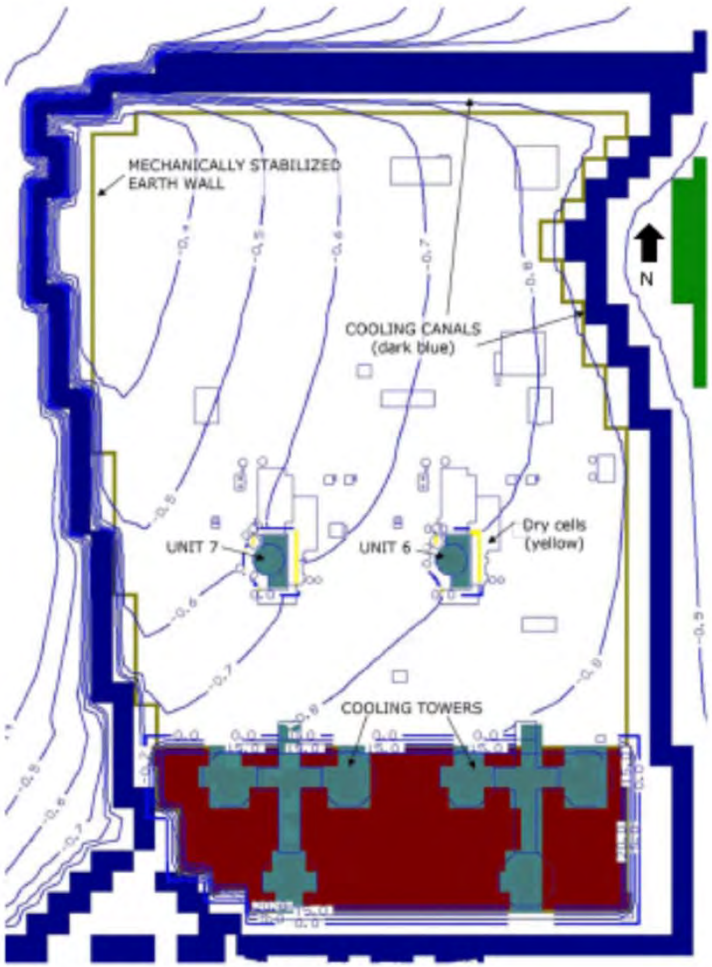
- Upper Floridan aquifer
  - Brackish water quality
- Middle confining unit
  - 1,000 ft thick at site
- Lower Floridan aquifer
  - Saline water quality
  - Includes highly transmissive interval called the Boulder Zone

Turkey Point Nuclear Plant Units 6 & 7

Subsection 2.4.12: Groundwater

Maximum Groundwater Level

- DCD site parameter requires maximum groundwater elevation ≥ 2 ft below plant grade
- Pre-existing site grade ≈ sea level
- Maximum site grade elevation = 25.5 ft NAVD 88 (plant grade = 26 ft NAVD 88)
- Maximum post-construction groundwater elevation ≈ 3 ft NAVD 88 (23 ft below plant grade)
- DCD requirements met
- Evaluation considered:
  - Sea level rise
  - Makeup water reservoir failure



Note: Groundwater level contours in ft NAVD 88.

Phase 2 Case 1 Simulated Groundwater Contours – Model Layer 1 Under Base-Case MWR Conditions
(FSAR Figure 2.4.12, 2CC-262)

Turkey Point Nuclear Plant Units 6 & 7

Subsection 2.4.12: Groundwater

Radial Collector Well (RCW) System

- Backup supply for cooling tower makeup water (86,400 gpm)
- 4 wells
- Each consists of central caisson on peninsula with radial, horizontal laterals extending under Biscayne Bay
  - Laterals up to 900 ft in length
  - Laterals 25-40 ft below bay bottom
- Operation limited to 60 days/12 months by permit
- Model results (continuous operation)
  - Drawdown limited to Units 1-5 plant site and peninsula
  - Water origins
    - Biscayne Bay: 97.8%
    - Inland sources: 2.2%

Radial Collector Well Drawdown within the Top Layer

(Based on FSAR Figure 2.4.12, 2CC-246)

Subsection 2.4.13: Accidental Releases of Radioactive Liquid Effluents in Ground and Surface Waters

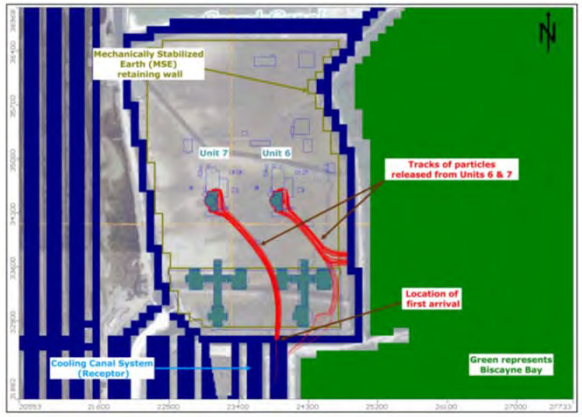
Approach

- Branch Technical Position 11-6

Groundwater

- Source
  - Postulated failure of effluent holdup tank located in auxiliary building
- Primary conceptual model (Case 1)
  - Release to groundwater, groundwater transport, discharge to Industrial Wastewater Facility (IWF), and migration from IWF to Biscayne Bay
  - IWF operational, RCW off
- Alternate conceptual model (Case 3)
  - Release to groundwater, groundwater transport, and discharge to Biscayne Bay
  - IWF not operational, RCW off

All Criteria related to accidental releases of radioactive liquid effluents have been met.



MODPATH Particle Tracking Case 1 Plan View (IWF-On, RCW-Off)
(FSAR Figure 2.4.13-202)

MODPATH Particle Tracking Case 3 Plan View (IWF-Off, RCW-Off)
(FSAR Figure 2.4.13-205)

Subsection 2.4.13: Accidental Releases of Radioactive Liquid Effluents in Ground and Surface Waters

Groundwater (cont.)

- Exposure scenario
  - Consumption of fish and mollusk/crustaceans harvested from Biscayne Bay
- Exposure concentrations
  - Travel times and concentrations determined from surficial aquifer model
- Dose calculation
  - Bioaccumulation factors from RG 1.109
  - Fish and mollusk/crustacean dietary factors from ANL/EAD-4
  - Dose conversion factors from EPA-520/1-88-020
- Results
  - Bounding dose below regulatory limit (10 CFR Part 20.1301)

Surface Water

- AP1000 outdoor tanks do not contain radioactive material
- Accidental release directly to surface water is not plausible

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- **Section 11.2 Liquid Waste Management System**

Turkey Point Nuclear Plant Units 6 & 7

FSAR CHAPTER 11

Paul Jacobs
Engineering Supervisor
New Nuclear Projects

Chapter 11 – Radioactive Waste Management

- **AP1000 DCD incorporated by reference**
  - Site-specific information
    - Liquid Waste Management System, PTN SUP 11.2-1
      - Liquid Waste Management System/Liquid waste piping integrity
      - Deep Well Injection System
      - Liquid effluent pathway analysis
        - » Groundwater modeling-Boulder Zone vertical and horizontal modeling
        - » Dose consequence

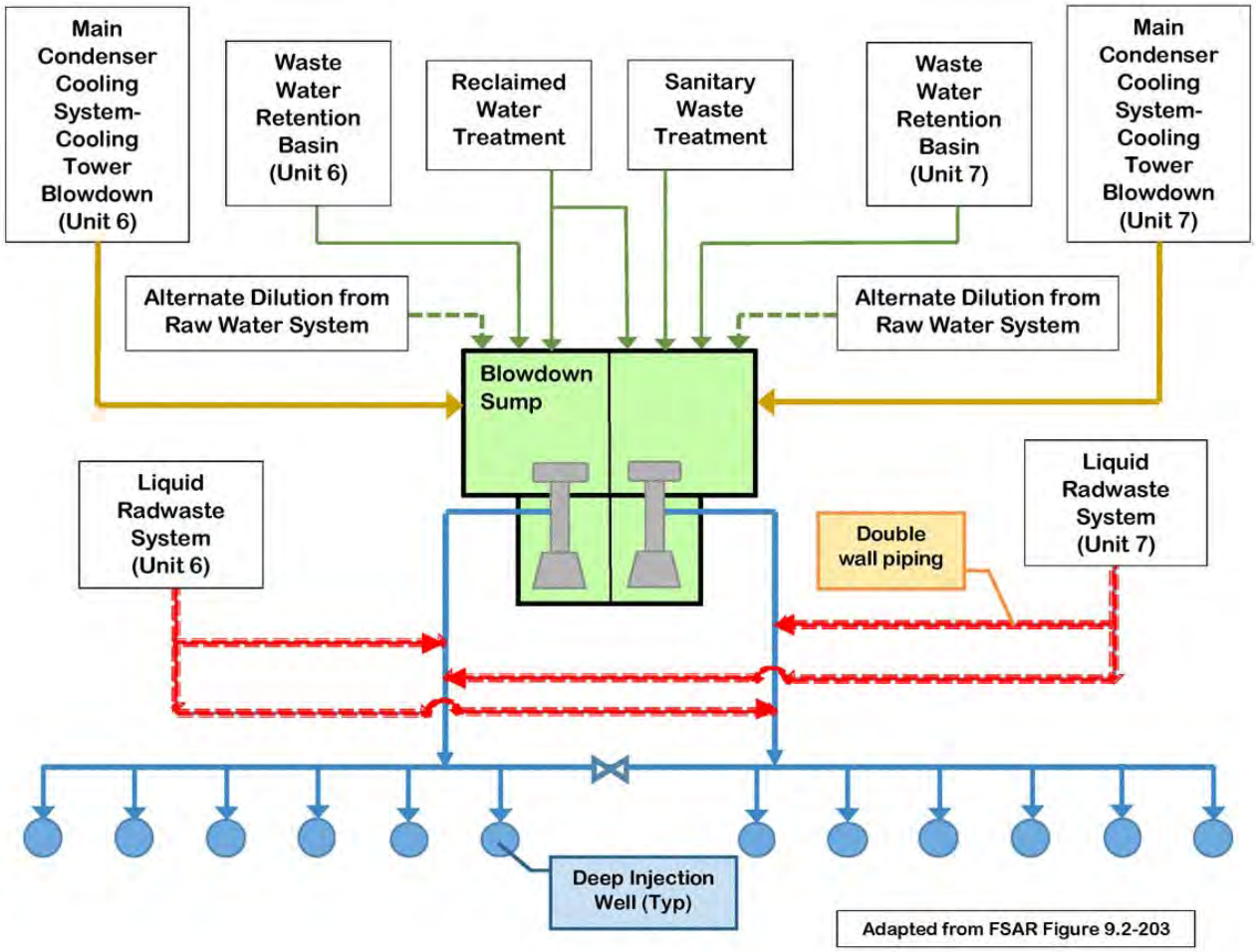
Liquid Waste Management System

Collection of liquid waste and liquid radioactive waste:

- **Liquid waste, wastewater from main condenser cooling system (blowdown), retention basin, and sanitary waste treatment system, collected in blowdown sump**
- **Processed liquid radioactive waste discharged to plant blowdown sump discharge line prior to release (injection)**
  - Required minimum dilution factor to control concentrations of liquid radioactive waste discharges to 10 CFR Part 20, Appendix B, effluent concentration limits met by specifying flow rates at blowdown sump discharge and liquid radwaste discharge lines
    - -- The required minimum dilution factor is calculated and applied prior to release of liquid radioactive waste
    - -- 6000 gpm typical dilution flow per unit (DCD Table 11.2-8)
  - Implementation of the liquid radioactive waste effluent control program in accordance with Units 6 & 7 Offsite Dose Calculation Manual

Turkey Point Nuclear Plant Units 6 & 7

Liquid Waste Management System Design



Liquid Waste Management System Design

Liquid Radwaste Piping Integrity/Monitoring

- **Liquid radwaste piping:**
  - The first section of piping (liquid radwaste system discharge pipeline) connects a combination of waste streams to the blowdown sump discharge piping downstream of the blowdown sump (red portion)
    - -- Guard-pipe enclosed
    - -- Leakage monitoring of pipe and underground pit where pipe ties into blowdown sump discharge implemented as part of Radiation Protection Program
  - The second section of piping (injectate piping) from the blowdown sump discharge connection point to deep injection wells
    - -- Single-walled, partially buried, constructed of steel
    - -- Piping, manifolds, valves, controls, and appurtenances designed to minimize inadvertent releases
    - -- Leakage monitoring consists of periodic visual inspection (accessible portions) as part of routine operation and maintenance activities or remote surveillance as part of Groundwater Monitoring Program

Section 11.2 – Liquid Waste Management System

Discharge of Blowdown Water Site Dependent

- **Cooling water study performed to select discharge alternative**
  - Scope of study included analyzing alternatives for discharging blowdown from circulating water system (CWS)
  - Nine potential alternatives were identified within reasonable proximity
    - -- Biscayne Bay
    - -- Card Sound
    - -- Atlantic Ocean
    - -- Card Sound Canal
    - -- Turning Basin
    - -- Lower Floridan Aquifer (Boulder Zone)
    - -- Wastewater Treatment Plant
    - -- Existing Cooling Canal System
    - -- Wetlands Rehydration
  - The potential alternatives went through a screening process which considered:
    - -- Statutory or legal restriction prohibiting discharge
    - -- Capacity of water body/treatment system to treat or accommodate discharge
    - -- Technical feasibility of construction/operation of discharge alternative
  - Only one alternative determined to be feasible, deep well injection of blowdown discharge to the Boulder Zone

Section 11.2 – Liquid Waste Management System

Lower Floridan Aquifer (Boulder Zone) Alternative for CWS Blowdown Discharge:

- **Consists of blowdown discharge via deep well injection system (DIS) to the Lower Floridan aquifer (Boulder Zone), approximately 3000 feet below ground surface (bgs)**

Boulder Zone - highly permeable zone containing saltwater:

- **Permitted by Florida Department of Environmental Protection for injection of sewage, industrial, and domestic wastes in South Florida**
  - Used in Florida for underground disposal of liquid waste since 1943
  - 180 active Class I injection wells permitted
    - -- Class I injection wells- industrial and municipal disposal wells which inject fluids beneath the lowermost unit containing an underground source of drinking water (USDW)
      - Most municipal Class I wells dispose of treated municipal effluent
      - Power plant industrial Class I wells primarily dispose of cooling tower blowdown

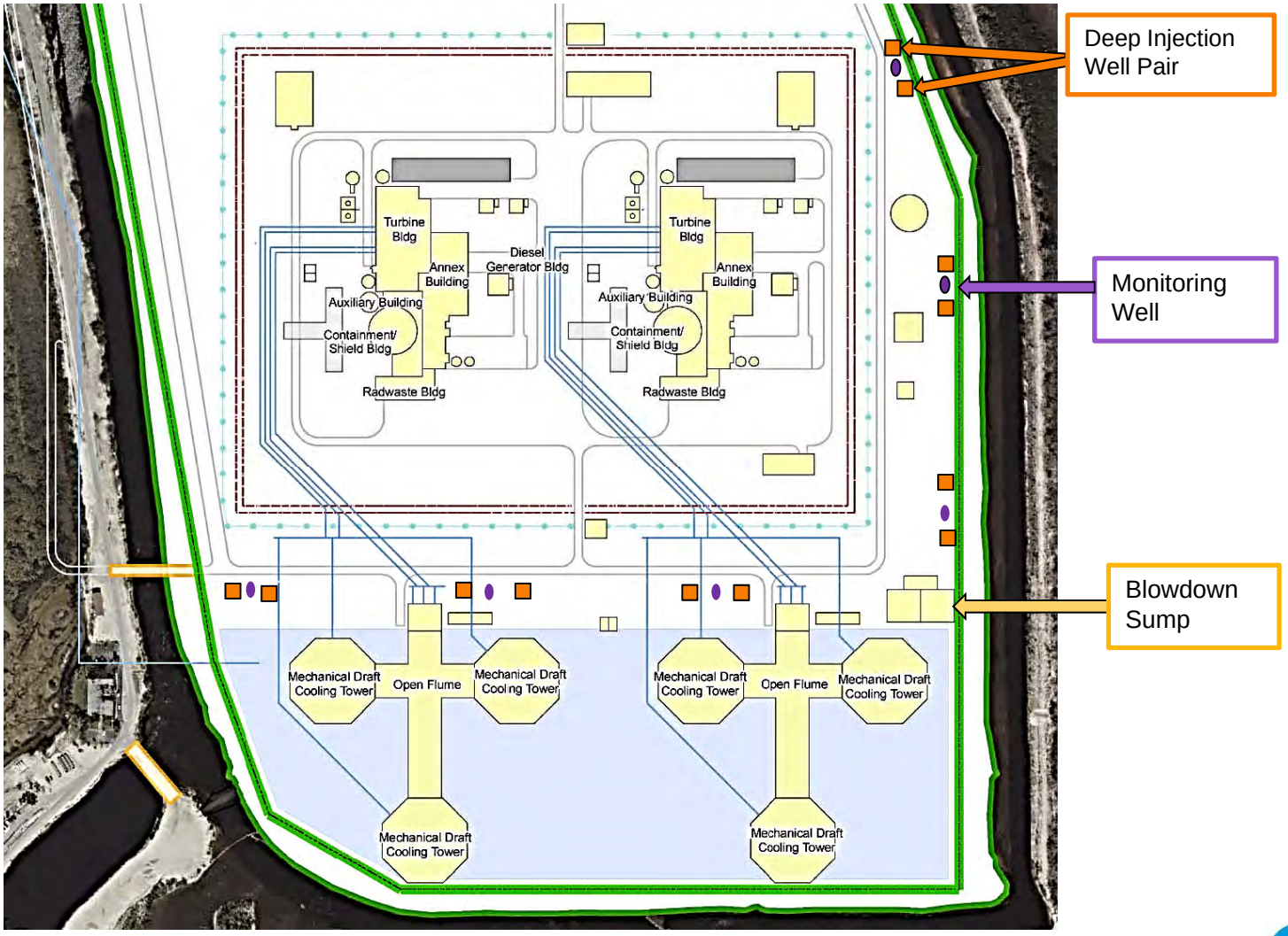
Liquid Waste Management System Design

DIS Design

- **12 Class I deep injection wells (10 primary/2 backup wells), 6 dual-zone monitoring wells, pipes, valves, pumps, and monitoring instrumentation**
- **Operation of DIS is identical for both reclaimed and saltwater—only number of deep injection wells used differs**
  - Reclaimed Water (4 cycles of concentration in cooling towers)
    - -- Deep well injection flow rate -12,500 gpm (normal) and 13,000 gpm (maximum) for two units
    - -- Liquid radwaste component - 3 gpm (normal) and 150 gpm (maximum) for two units
    - -- 3 deep injection wells sufficient (2 active/1 backup)
  - Saltwater (1.5 cycles of concentration in cooling towers)
    - -- Deep well injection flow rate - 58,000 gpm (normal) and 59,000 gpm (maximum) for two units
    - -- Liquid radwaste component is 3 gpm (normal) and 150 gpm (maximum) for two units
    - -- 11 deep injection wells sufficient (9 active/2 backup)

Turkey Point Nuclear Plant Units 6 & 7

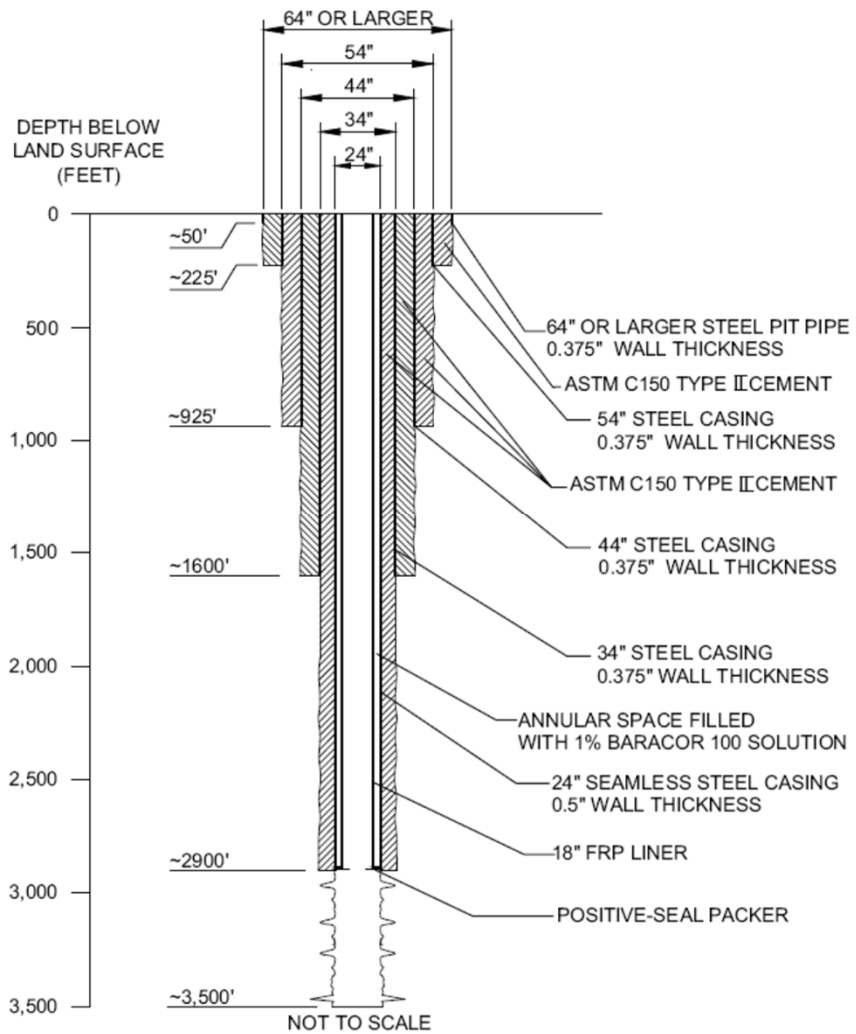
Liquid Waste Management System



Source: FSAR Figure 1.1-201 and ER Figure 2.3-4

Turkey Point Nuclear Plant Units 6 & 7

Liquid Waste Management System Design



Source: FSAR Figure 9.2-204

Liquid Waste Management System Design

DIS – Injection Well Design

- **Multiple concentric casings**
  - 54-, 44-, 34-, and 24-inch diameter steel fully cemented casings
  - 0.375-inch wall thickness except final casing is 0.5-inch
  - 34-inch and 24-inch diameter casings set below base of USDW
- **Fiberglass Reinforced Pipe (FRP) injection tubing**
  - 18-inch FRP injection tube installed within the final casing
  - Protects final casing from corrosion

DIS – Monitoring Well Design

- **Multiple concentric casings**
  - 34-, 24-, 16-, and 6.625-inch diameter casings
  - 34- and 24- inch diameter casings are 0.375-inch wall thickness steel; 16-inch diameter casing is 0.5-inch wall thickness steel; and 6.625-inch diameter casing is FRP to provide corrosion protection
- **Monitors two separate zones**
  - Upper Zone monitors just above or at the base of the USDW
  - Lower Zone monitors below the base of the USDW just above confining unit

Testing During/At Completion of Construction

- **Injection Wells**
  - Cement bond log, temperature log, video survey and pressure test performed on 24-inch casing prior to installation of FRP liner to identify leaks on the 24-inch casing
  - Pressure test of annular space between 24-inch and FRP liner to identify leaks in 24-inch casing, FRP liner, seal at top and bottom of annulus
  - Video survey and temperature log of FRP liner to identify leaks in FRP liner
- **Monitor Wells**
  - Cement bond log, video survey and pressure test performed on 6.625-inch casing to identify leaks in 6.625-inch casing
  - Pressure test and video survey of 6.625-inch casing

Testing During Operational Testing and Operation

- **Injection Wells**
  - Continuous pressure monitoring of annular space between 24-inch and FRP liner to identify leaks in 24-inch casing, FRP liner, or seal at top and bottom of annulus
  - Continuous flowrate monitoring to ensure maximum permitted flowrate is not exceeded
  - Continuous injection pressure monitoring to ensure maximum permitted injection pressure is not exceeded
  - Weekly sampling of waste stream
    - -- Chloride, total dissolved solids, sulfate, temperature, pH
    - -- Additional parameters likely to be added upon starting operational testing
    - -- Frequency to be reduced to monthly after 6 months and FDEP concurrence

Testing During Operational Testing and Operation

- **Monitoring Wells**
  - Continuous water level monitoring of both monitoring intervals of each dual-zone monitor well
  - Water level monitoring detects development of holes in casings
  - Water level monitoring used to assist in identification of impacts to monitored intervals by injected fluids
  - Weekly sampling of both monitoring zones
    - -- Chloride, total dissolved solids, sulfate, temperature, pH
    - -- Additional parameters likely to be added upon starting operational testing
    - -- Frequency to be reduced to monthly after 6 months and FDEP concurrence

Testing During Operational Testing and Operation

- **Injection Wells**
  - Mechanical Integrity Testing required every 5 years
    - -- Video survey – visual inspection of injection tubing, packer and open hole interval
    - -- High-resolution temperature logging – leak detection
    - -- Annular pressure test – test for leaks in tubing, final casing and packer
    - -- Radioactive tracer survey – test the integrity of the cement seal at the base of the final casing
    - -- Interpretation of previous five years of monitoring and operating data
    - -- Results summarized in report submitted to FDEP for review and approval

Section 11.2 – Liquid Waste Management System

DIS Design

- **Traditional disposal (discharge) method for liquid radioactive effluent**
  - Direct discharge to surface water where radioactive effluent is diluted and dispersed in receiving waters and immediately available for member-of-the-public exposure
- **Turkey Point Units 6 & 7 DIS**
  - Non-traditional disposal (discharge) method
  - Due to depth (approximately 3000 ft bgs) and presence of confining units, it is not expected, under normal operating conditions, that radioactivity injected into Boulder Zone would reach either an USDW or surface environment
- **FPL performed and provided an analysis under provisions of 10 CFR 20.2002 to demonstrate compliance with 10 CFR Part 50, Appendix I**
  - Radiological assessment methods used to quantify radiological impacts and demonstrate compliance with NRC regulations for effluents discharged in surface water bodies are not directly applicable

Section 11.2 – Liquid Waste Management System

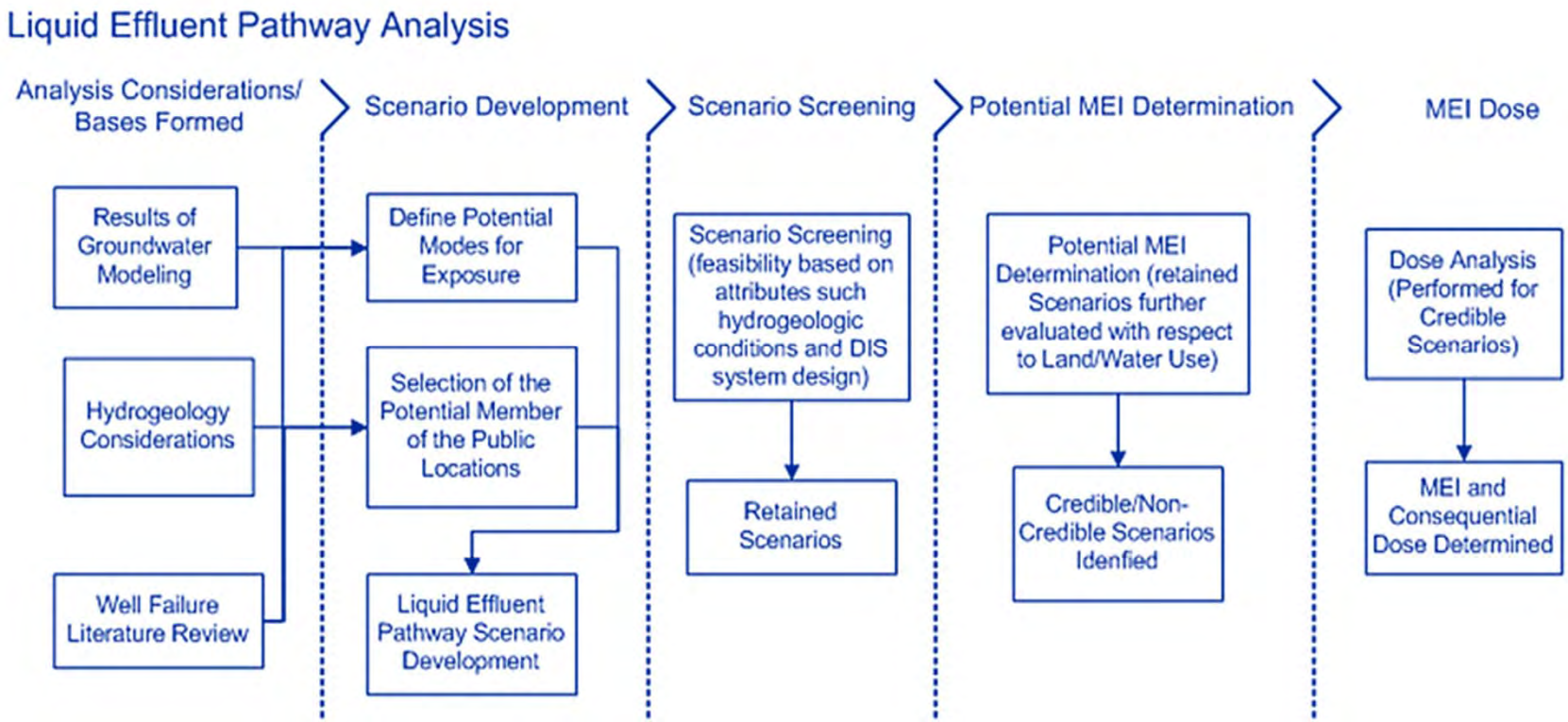
Performance Assessment

- **Performed to assess the environmental fate and transport of liquid effluent discharged via DIS to the Boulder Zone**
  - Liquid Effluent Pathway Analysis
    - -- Designed to identify any appropriate member-of-the-public receptors and ultimately determine the Maximally Exposed Individual (MEI) through a process in which postulated exposure scenarios were screened for feasibility/credibility
    - -- In determining exposure scenarios extraordinary events/assumptions had to be postulated in order for the scenario to result in a member of the public being exposed to radioactive effluents
    - -- Culminated in an assessment of doses potentially delivered to the MEI as a result of the injection of radioactive effluent to the Boulder Zone
    - -- MEI dose assigned using Regulatory Guide 1.109

Turkey Point Nuclear Plant Units 6 & 7

Section 11.2 – Liquid Waste Management System

Process:



Section 11.2 – Liquid Waste Management System

Liquid effluent pathway analysis considerations/bases

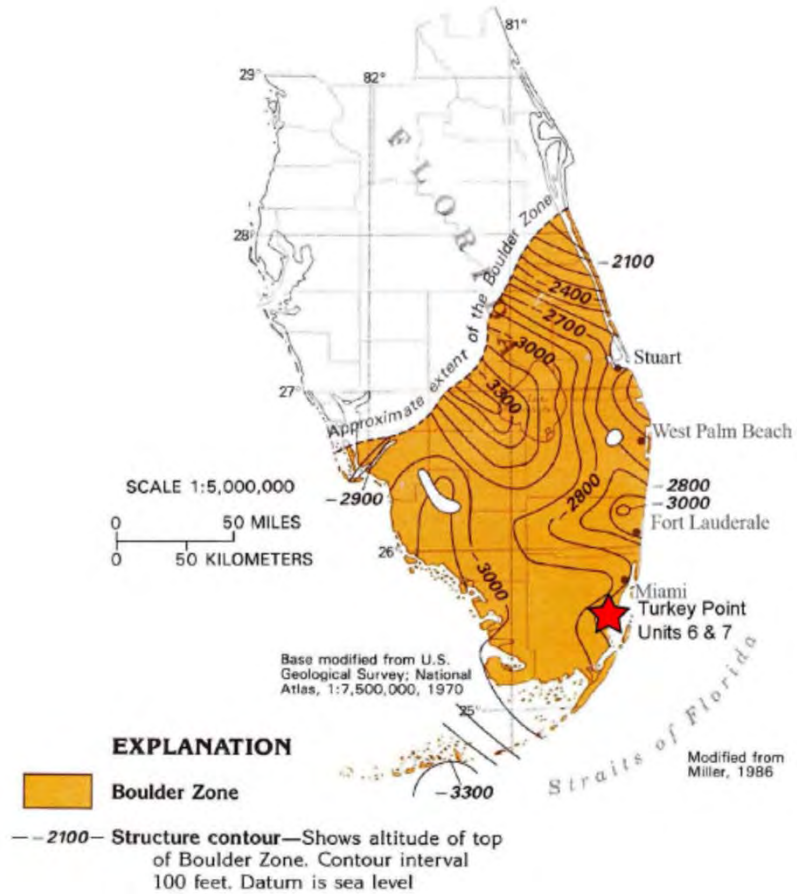
- **Because liquid effluent is released via deep well injection, there is no surface release; groundwater transport is the only exposure pathway**
  - Groundwater Modeling
    - -- Radial Transport
    - -- Vertical Transport
  - Hydrogeology
  - Well Failure
  - Land Use

Turkey Point Nuclear Plant Units 6 & 7

Groundwater Modeling Deep Well Injection

Boulder Zone Characteristics

- **Areally extensive**
- **3,000 ft below ground surface at site**
- **500 ft thick**
- **Highly transmissive**
  - 250,000 ft^2/d at site
- **Relatively stagnant**
- **Used for municipal and industrial wastewater disposal**
  - Located below underground sources of drinking water (USDW)
  - 180 Class I injection wells permitted



The Boulder Zone in Southern Florida
Source: FSAR Figure 2.4.12-241

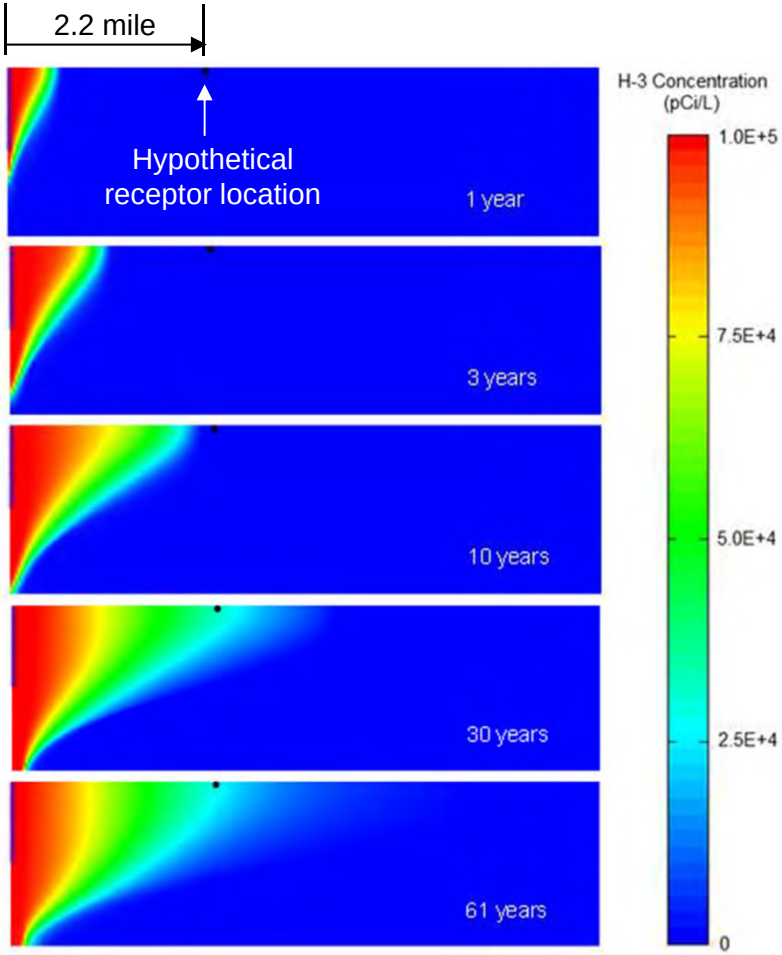
Groundwater Modeling Deep Well Injection

Radial Transport Model in the Boulder Zone (BZ)

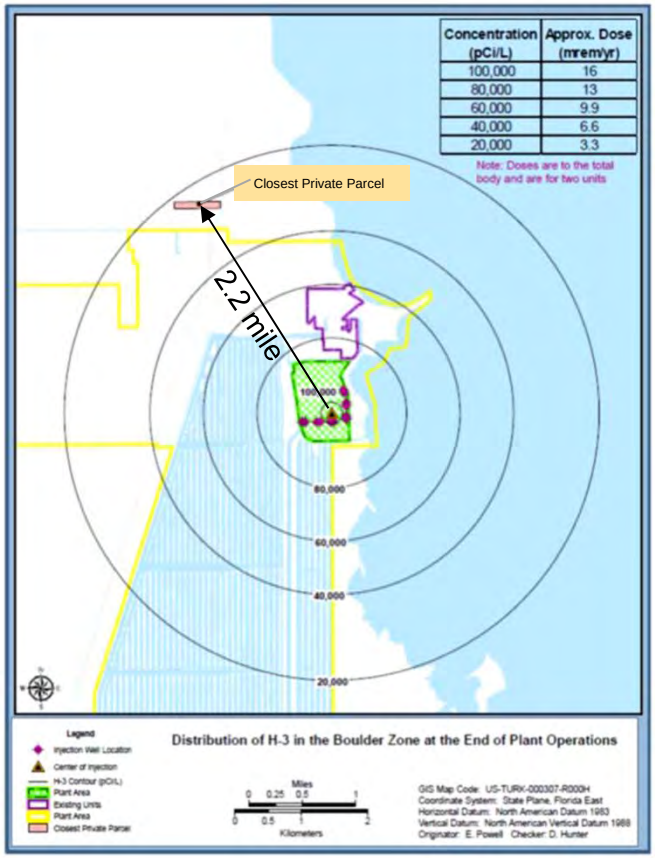
- **Objective**
  - Determine radionuclide concentrations and spatial distributions in BZ
  - Provide input to MEI dose calculation
- **Variable density groundwater flow and transport model (SEAWAT)**
  - Injectate density differs from BZ water (36.2 kg/m^3 TDS)
    - -- Cycled reclaimed water (2.7 kg/m^3 TDS) => “floats”
    - -- Cycled saltwater from radial collector well (57.0 kg/m^3 TDS) => “sinks”
- **Conceptual model**
  - Two-dimensional, radially symmetric flow
  - BZ confined
  - Continuous injection
- **Radionuclides of interest**
  - H-3, Sr-90, Cs-134 and Cs-137 => 99% of dose
  - No adsorption

Turkey Point Nuclear Plant Units 6 & 7

Groundwater Modeling Deep Well Injection



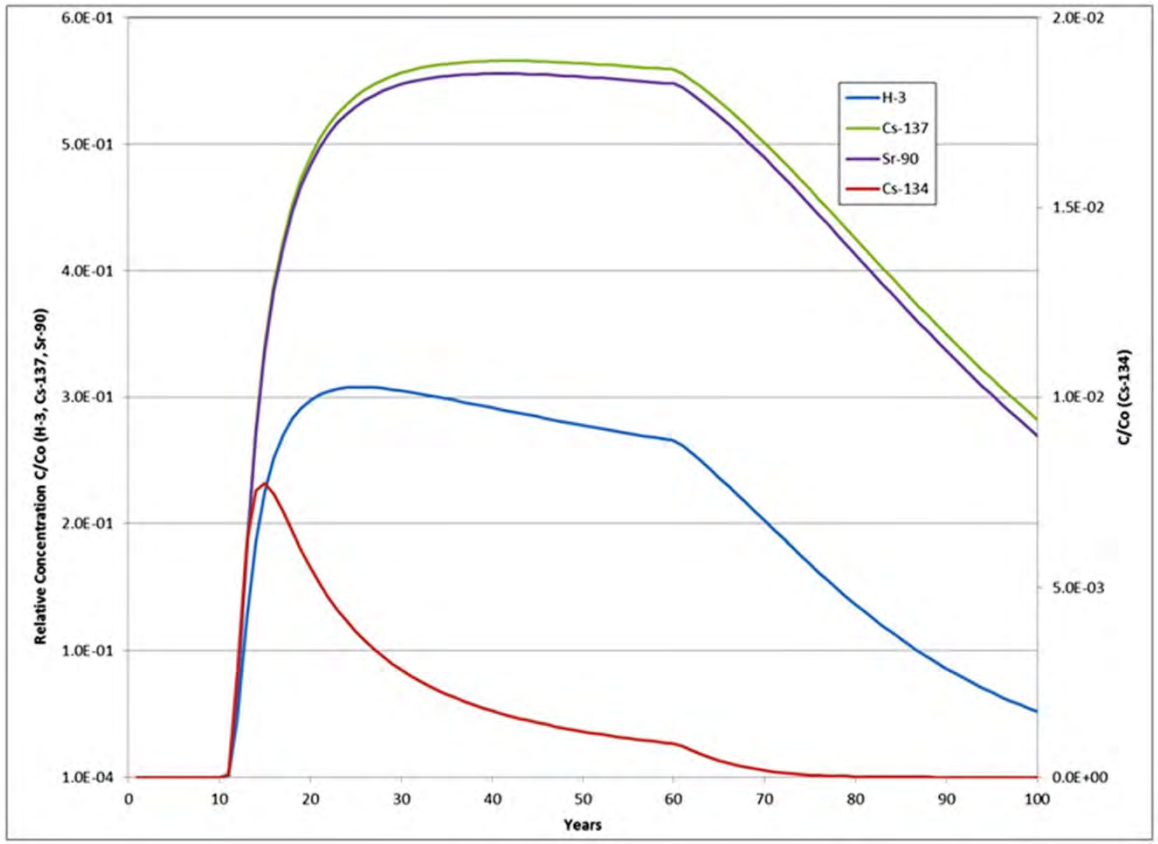
Base Case Boulder Zone Tritium Concentrations
Source: FSAR Figure 11.2-201



Model Layer 1 Distribution of Tritium in the Boulder Zone for the Base Case Simulation at the End of Plant Operations
Source: FSAR Figure 11.2-202

Turkey Point Nuclear Plant Units 6 & 7

Groundwater Modeling Deep Well Injection

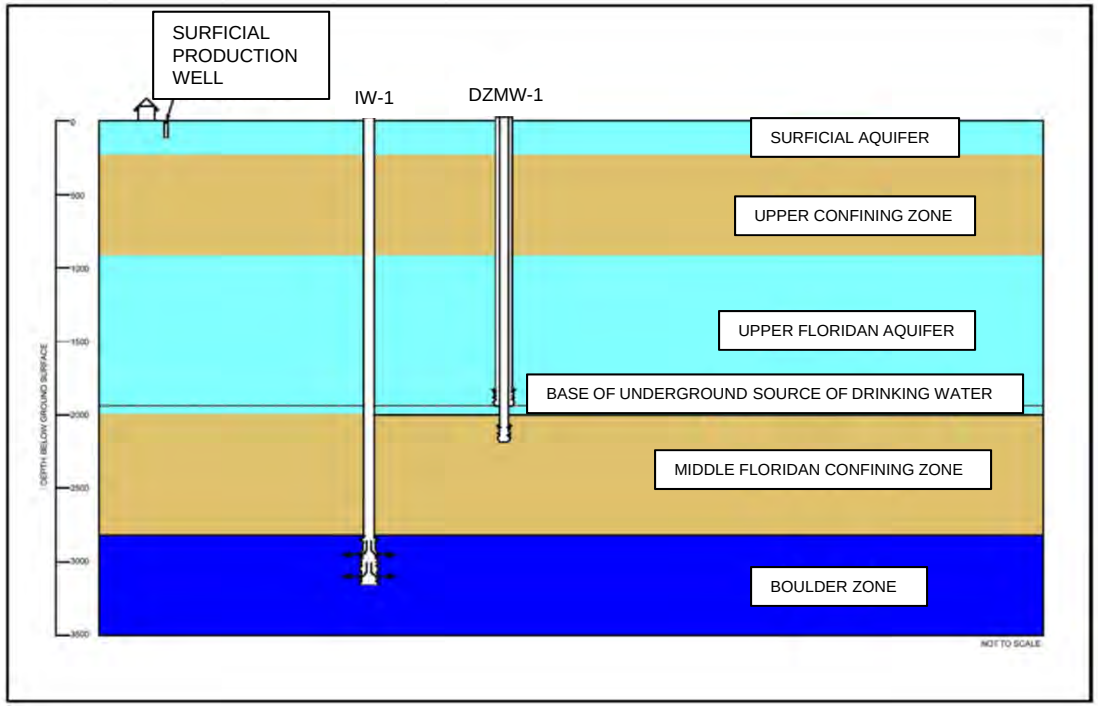


Model Layer 1 Base Case Relative Breakthrough Curves at 2.2-mile Hypothetical Receptor Location
Source: FSAR Figure 11.2-209

Groundwater Modeling Deep Well Injection

Vertical Transport Model

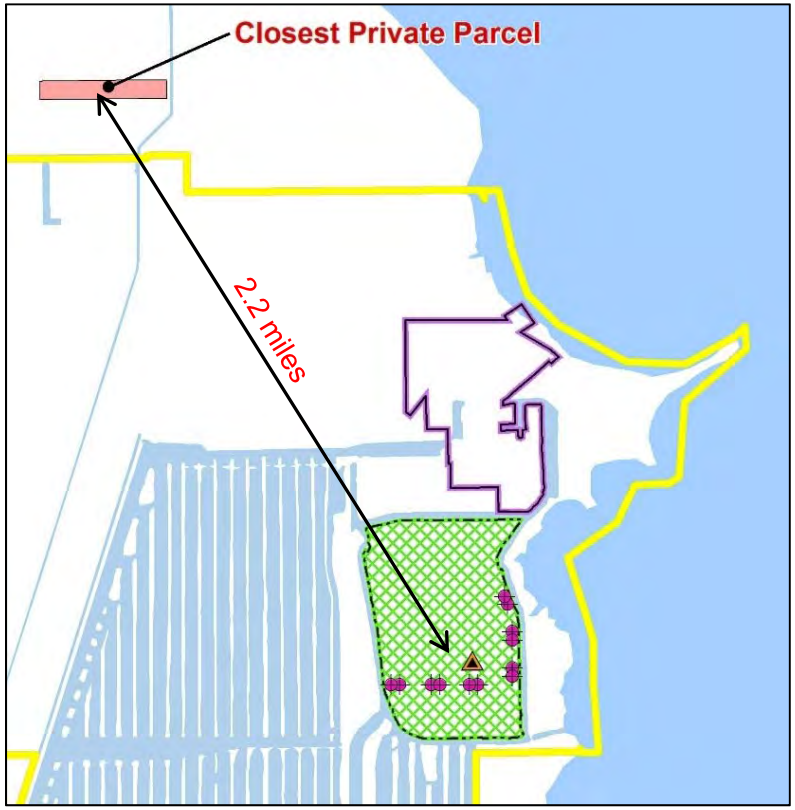
- **Objective**
  - Evaluate upward migration of injectate from BZ through the Middle Confining Unit to the Upper Floridan aquifer
- **Model attributes**
  - Variable density groundwater flow and transport model (SEAWAT)
  - 3D model simulating injection of cycled reclaimed water into BZ
- **Model results**
  - 300 ft vertical migration into Middle Confining Unit after 100 years
  - Migration of radionuclides out of the BZ not significant



Typical Injection Well System
Source: FSAR Figure 2.4.12-244

Section 11.2 – Liquid Waste Management System

- **Scenario Development/Screening**
  - Under normal operation, radiological exposure of any consequence to the public is incredible. However, to meet the requirements of Regulatory Guides 1.109 and 1.113, developed for surface water discharge systems, the following process was used:
    - -- Potential exposure modes identified
    - -- Selection of the potential member-of-the-public locations
    - -- Liquid effluent pathway scenario development
- **MEI Determination**
  - Two scenarios ultimately evaluated at MEI location 2.2 miles away:
    - -- Off-normal operation
    - -- Inadvertent intrusion (bounding)



Location of Closest Private Parcel
Source: FSAR Figure 11.2-211

Section 11.2 – Liquid Waste Management System

MEI Dose Analysis

- **Inadvertent Intrusion –Member of the public drills well into the Upper Floridan aquifer immediately above a failure in the middle confining unit, resulting in following exposure pathways:**
  - Ingestion of water and irrigated vegetables, milk and meat
  - Inhalation of airborne contaminants in vapor cloud formed from evaporation of a postulated liquid puddle formed during drilling of well
  - Immersion in vapor cloud from evaporation of a postulated liquid puddle formed during drilling of well
  - Exposure to direct radiation from contamination in puddle formed on the ground during drilling of well
  - Applies to MEI only, as the well is assumed to be on private property

Section 11.2 – Liquid Waste Management System

MEI Dose Analysis—Liquid Effluent

- **Ingestion doses are calculated using the LADTAP II computer program**
  - Effective decay time during transit determined for each radionuclide, based on concentrations at injection point (calculated using DCD Table 11.2-7 release rate and site-specific dilution flow rate of 6230 gpm per unit) and the MEI location (calculated using SEAWAT)
  - A separate LADTAP II run is made for each radionuclide, with the release rate being the DCD Table 11.2-7 value multiplied by 365/292 (scaling the assumed days of operation in DCD to full calendar year) and transit time being the calculated decay time
  - LADTAP II runs are for two units, consistent with the SEAWAT model for peak concentrations
  - Doses during drilling via inhalation, immersion, and deposition pathways are calculated using Environmental Protection Agency guidance and Regulatory Guide 1.109

Section 11.2 – Liquid Waste Management System

MEI Dose Analysis-Liquid Effluent

Inadvertent Intrusion Subsidence Driller Dose Summary

Pathway	Dose (mrem/year) per Unit[b]	
	Total Body	Liver[a]
Annual Ingestion of Water and Irrigated Foods	2.7	3.8
Inhalation During Drilling	8.2E-02	8.3E-02
Air Immersion During Drilling	2.6E-06	2.6E-06
Deposition During Drilling	1.8E-05	0
Total	2.8	3.9
10 CFR Part 50, Appendix I Design Objectives	3	10

(a) Liver is the organ receiving the maximum dose.

(b) Doses are calculated based on the operation of two units, as this maximizes the doses at offsite receptors. The calculated two-unit dose is then divided by two to obtain the dose per unit.

Source: FSAR Table 11.2-209

Calculated doses meet 10 CFR 50 Appendix I

Section 11.2 – Liquid Waste Management System

Bounding MEI Dose Analysis

- **In assigning a 10 CFR 50 Appendix I compliance dose, extremely conservative assumptions were invoked:**
  - Radionuclide Transport in Groundwater
    - -- Radionuclide concentrations are not depleted by sorption to the subsurface matrix
    - -- Boulder Zone is a confined, non-leaky aquifer (minimizing decay time)
    - -- Injection occurs continuously (minimizing decay time)
  - MEI Exposure Scenario
    - -- Subsistence driller
      - – Ignores all notification and permitting requirements for a large drilling operation
      - – Has the financial ability to plan and undertake a large drilling operation
      - – Effectively drills into the Boulder Zone (confinement and Upper Floridan dispersion ignored)
      - – Is unprotected while continually exposed to affected water, mist, and drill cuttings
      - – Uses affected water to maintain livestock and food crops
      - – Harvests and consumes affected livestock and food crops
      - – Dose due to inhalation, immersion, and deposition is doubled
      - – Is always in the age group receiving the maximum dose (‘omnireceptor’)
    - -- Peak isotopic concentrations are concurrent

Boulder Zone salinity is similar to seawater.

QUESTIONS?

U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

Staff Presentation to ACRS Subcommittee

Turkey Point
Units 6 and 7 COL Application

Overview of Advanced Safety Evaluation (ASE) and ASE Chapter 1 Introduction and Interfaces

August 18, 2016

ACRS Presentation Outline
Day 1 (August 18, 2016)

ASE Section	Title
2.1	Geography and Demography
2.2	Nearby Industrial, Transportation, and Military Facilities
2.3	Meteorology
2.4	Hydrologic Engineering
11.2	Liquid Waste Management Systems

ACRS Presentation Outline
Day 2 (August 19, 2016)

ASE Section	Title
2.5	Geology, Seismology, and Geotechnical Engineering
3.5 3.7	Missile Protection Seismic Design
13.3	Emergency Planning
19	Probabilistic Risk Assessment
20	Requirements Resulting from Fukushima Near-Term Task Force Recommendations
21	Design Changes Proposed in Accordance with ISG-11

Project Management Team

- Manny Comar, Lead PM Turkey Point Units 6 and 7 COL
- Lisa Schleicher, Chapter 2 “Site Characteristics”
- Ruth Reyes, Chapter 3 “Design of Structures, Components, Equipment, and Systems”
- Jordan Hoellman, Chapter 21 “Design Changes Proposed in Accordance with ISG-11”

Technical Staff Review Team – Day 1

- Rao Tammara, Site Hazards (Sections 2.1 & 2.2)
- Kevin Quinlan, Meteorology (Section 2.3)
- Brad Harvey, Meteorology (Section 2.3)
- Joseph Giacinto, Hydrology (Section 2.4)
- Zachary Gran, Radiation Protection (Section 11.2)

Presentation Scope

- Staff's philosophy for presentations
  - The staff does not intend to brief the ACRS subcommittee on Certified Design or standard content material

- The staff intends to provide a high-level description of the site-specific content on a chapter by chapter basis
  - The staff does not intend to brief every site-specific item, rather it intends to brief the ACRS on a subset of key issues, as appropriate

Turkey Point COL Application

- The Turkey Point COLA consists of—
  - material incorporated by reference (IBR) from the AP1000 Design Control Document (DCD), Revision 19
  - the Final Safety Analysis Report, Revision 7
    - Standard content
    - Plant-specific content
    - Departures to be addressed under ISG-11

Safety Evaluation for the Turkey Point COLA

- The Turkey Point Advanced Safety Evaluation references the Vogtle Final Safety Evaluation Report
    - The standard content evaluation material from Vogtle is double-indented and italicized
    - The standard content evaluation contains some language from the Bellefonte safety evaluation report with open items to capture evaluations that were performed when Bellefonte was the reference COL
- Turkey Point plant specific information is addressed directly in the ASE
- Departures that meet the criteria of ISG-11 were evaluated in the Levy FSER and the evaluation material is double-indented and italicized in Chapter 21 of the Turkey Point ASE

Presentation Scope Continued

- Chapters that will not be presented include the following:
  - Chapter 4, “Reactor”
  - Chapter 5, “Reactor Coolant System and Connected Systems”
  - Chapter 6, **“Engineered Safety Features”**
  - Chapter 7, “Instrumentation and Control”
  - Chapter 8, “Electric Power”
  - Chapter 9, **“Auxiliary Systems”**
  - Chapter 10, “Steam and Power Conversion System”
  - Chapter 12, “Radiation Protection”
  - Chapter 14, “Initial Test Programs”
  - Chapter 15, “Transient and Accident Analyses”
  - Chapter 16, “Technical Specifications”
  - Chapter 17, “Quality Assurance”
  - Chapter 18, “Human Factors Engineering”

Turkey Point Units 6 and 7 COL Overview

Part Number	Description	Staff Evaluation
1	General and Financial Information	ASE Section 1.5.1
2	Final Safety Analysis Report	In Appropriate ASE Chapters
3	Environmental Report	Final Environmental Impact Statement
4	Technical Specifications	ASE Chapter 16
5	Emergency Plan	ASE Section 13.3
6	Limited Work Authorization Request	Not Applicable
7	Departures and Exemption Requests	In Appropriate ASE Chapters
8	Safeguards / Security Plans	ASE Section 13.6
9	Withheld Information	In Appropriate ASE Chapters
10	Proposed Combined License Conditions (Including ITAAC)	In Appropriate ASE Chapters
11	Enclosures (Cyber Security, QA, LOLA)	ASE Sections 13.8, 17 and, 19A

Overview of Turkey Point Units 6 and 7 COL FSAR Chapter 1

FSAR Section	Summary of Departures/ Supplements
1.1 Introduction	Incorporated By Reference (IBR) with Standard and Site-Specific Supplements
1.2 General Plant Description	IBR with Site-Specific Supplements
1.3 Comparison with Similar Facility Designs	IBR
1.4 Identification of Agents and Contractors	IBR with Site-Specific Supplements
1.5 Requirements for Further Technical Information	IBR
1.6 Material Referenced	IBR with Standard and Site-Specific Supplements
1.7 Drawings and Other Detailed Information	IBR with Site-Specific Supplements
1.8 Interface for Standard Designs	IBR with Site-Specific Supplements
1.9 Compliance with Regulatory Criteria	IBR with Site-Specific Supplements
1.10 Nuclear Power Plants to be Operated on Multi-Unit Sites	Standard and Site-Specific Supplements
Appendix 1A	Conformance with Regulatory Guides
Appendix 1B	Severe Accident Mitigation Design Alternatives
Appendix 1AA	Conformance with Regulatory Guides

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Protecting People and the Environment

Staff Presentation to ACRS Subcommittee

Turkey Point
Units 6 and 7 COL Application

ASE Chapter 2, Site Characteristics

August 18, 2016

ASE Chapter 2, Site Characteristics

- **Section 2.1** – Geography and Demography
- **Section 2.2** – Nearby Industrial, Transportation, and Military Facilities
- **Section 2.3** – Meteorology
- **Section 2.4** – Hydrologic Engineering
- **Section 2.5** – Geology, Seismology, and Geotechnical Engineering

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Protecting People and the Environment

Staff Presentation to ACRS Subcommittee

Turkey Point
Units 6 and 7 COL Application

ASE Chapter 2, Site Characteristics
Section 2.1 – Geography and Demography
Section 2.2 – Nearby Industrial, Transportation, and Military Facilities

Rao Tammara

August 18, 2016

2.1 Geography and Demography

Site Location and Description

Coordinates, site boundaries, orientation of principal plant structures, location of highways, railroads, waterways that traverse the exclusion area

Exclusion Area Authority and Control

Legal authority, control of activities unrelated to plant operation, arrangements for traffic control

Population Distribution

Current and future population projections, characteristics of the Low Population Zone (LPZ), population center distance, and population density

Staff reviewed the applicant-addressed above information and also staff independently verified.

2.1 Geography and Demography

<u>Population Density</u>

- Staff also independently evaluated the population density
- Density exceeded the criterion of 500 persons/sq.mile within 20 miles of the site at the time of license approval and 5 years thereafter, as provided in Regulatory Position C4 of RG 4.7
- Provided rationale, justification, merits and advantages of the Turkey Point site selected over the alternative sites for site suitability and acceptability

Based on the review of information provided by the applicant and staff's independent confirmatory evaluation, staff found the applicant's information to be adequate and acceptable as it meets the requirements of 10 CFR 100.20, and guidance provided in NUREG-0800.

2.2 Nearby Industrial, Transportation, and Military Facilities

<u>Identification of Potential Hazards in Site Vicinity</u>

- Maps of site and nearby significant facilities and transportation routes
- Description of facilities, products, materials, and number of people employed
- Description of pipelines, highways, waterways, railroads and airports
- Projections of industrial growth

Staff reviewed the applicant addressed information pertaining to the location and description of Nearby Industrial, Transportation and Military Facilities for the evaluation of potential hazards for the safe operation of the proposed plant. Staff independently verified the locations and descriptions of the facilities, including transportation routes and pipelines from the data available in public domain, and found it to be acceptable as the information meets the guidance provided in NUREG-0800 Section 2.2.1-2.2.2.

2.2 Nearby Industrial, Transportation, and Military Facilities

Evaluation of Potential Accidents

Explosions and Flammable Vapor Clouds

Truck Traffic**, Pipelines**, Waterway Traffic, Railroad traffic

Release of **Hazardous Chemicals**

Transportation Accidents, Major Depots, Storage Areas, Onsite Storage tanks

Fires

Transportation Accidents, Industrial Storage Facilities, Onsite Storage

The staff's presentation focuses on the following topics of general attention and interest: Pipelines, Hazardous Chemicals, and Transportation Accidents

2.2 Nearby Industrial, Transportation, and Military Facilities

Evaluation of Potential Accidents

Pipelines

The minimum safe distance of 3,097 ft to 1 psi overpressure is lower than actual distance of 4,535 ft to nearest SSC (Unit 6 auxiliary building)

Control Room Habitability

- The calculated concentration of chlorine and sodium hypochlorite outside the inlet to control room exceeded respective immediately dangerous to the life and health (IDLH) concentrations
- The control room concentration is determined to be lower than the IDLH value thereby posing no adverse impact on control room habitability. This is further addressed in ASE Ch. 6.4.

2.2 Nearby Industrial, Transportation, and Military Facilities

Evaluation of Potential Accidents

Aircraft Crash Probability

The calculated aircraft crash probability of 3.86×10^{-6} per year exceeds the criterion. However, the core damage frequency (CDF) associated with that aircraft crash probability is determined to be lower than 1×10^{-8} per year, and poses no due risk to the health and safety of public. This is further reviewed in ASE Section 19.

Staff Independent Confirmatory Analysis

Staff used conservative total flight data from within 5 miles of the plant site obtained from the Federal Aviation Administration to determine aircraft crash probability of 5.26×10^{-7} per year, and is found to be within the range of acceptable criterion on the order of magnitude of 1×10^{-7} per year.

2.2 Nearby Industrial, Transportation, and Military Facilities

Evaluation of Potential Accidents

Staff reviewed the applicant addressed site specific evaluations of potential accidents. Staff also performed independent confirmatory calculations in confirming the applicant's conclusions. Based on the review of the applicant-provided information, responses to the requests for additional information (RAIs), staff evaluations and staff's independent confirmatory analyses, the staff found the applicant's conclusions to be acceptable as the evaluations are in accordance with the guidance provided in NUREG-0800 Section 2.2.3, and meet regulatory requirements of 10 CFR 100.20(b).

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Staff Presentation to ACRS Subcommittee

Turkey Point
Units 6 and 7 COL Application

ASE Chapter 2, Site Characteristics
Section 2.3 – Meteorology

Kevin Quinlan

August 18, 2016

Section 2.3 – Meteorology
Supplemental Information, Departures, and COL items

- PTN SUP 2.0-1 – Comparison Table of Site Parameters and Site Characteristics
- PTN DEP 2.0-1 – Operating Basis Wind Speed
- PTN DEP 2.0-2 – Maximum Normal Non-Coincident Wet-Bulb Temperature
- PTN DEP 2.0-3 – Maximum Safety Non-Coincident Wet-Bulb Temperature
- PTN DEP 2.0-4 – Exclusion Area (site) Boundary Distance
- PTN COL 2.3-1 – Regional Climatology
- PTN COL 2.3-2 – Local Meteorology
- PTN COL 2.3-3 – Onsite Meteorological Measurements Program
- PTN COL 2.3-4 – Short-Term Diffusion Estimates
- PTN COL 2.3-5 – Long-Term Diffusion Estimates

Section 2.3 – Meteorology
Regional Climatology

2.3.1 Regional Climatology - Comparison of climate related site parameters and site characteristics

Operating Basis Wind Speed (3-second gust)

- **PTN DEP 2.0-1** states that the 50-year return period, 3-second gust wind speed value of 150 mph exceeds the AP1000 DCD site parameter value of 145 mph

Ambient Air Temperature and Humidity

- **PTN DEP 2.0-2** states that the maximum normal (0.4% annual exceedance) non-coincident wet-bulb temperature of 81.5 °F exceeds the AP1000 DCD site parameter value of 80.1 °F
- **PTN DEP 2.0-3** states that the maximum safety (100-year return period) non-coincident wet-bulb temperature of 87.4 °F exceeds the AP1000 DCD site parameter value of 86.1 °F

Maximum Tornado and Hurricane Wind Speed

Section 2.3: Meteorology
Local Meteorology and Onsite Meteorological Measurements Program

2.3.2 Local Meteorology

- Addressed the cooling tower-induced effects on temperature, moisture, and salt deposition
- Provided detailed information showing that the Turkey Point Units 6 and 7 meteorological data is representative of the site area

2.3.3 Onsite Meteorological Measurements Program

- Applicant described the onsite meteorological measurement program and provided a copy of the resulting meteorological data
- Applicant's onsite meteorological data met RG 1.23, Revision 1 criteria

Section 2.3: Meteorology
Short and Long Term Diffusion Estimates

2.3.4 Short-Term (Accident) Diffusion Estimates

- Comparison of atmospheric dispersion site parameters and site characteristics
  - **PTN DEP 2.0-4** stated that DCD Table 2-1 lists an EAB site parameter distance of 0.5 miles. Every direction sector distance (except for S, SSW, and SSE sectors) are less than the 0.5 mi site parameter
- COL FSAR presented exclusion area boundary (EAB) & LPZ χ/Q values
- COL FSAR presented Control Room χ/Q values

2.3.5 Long-Term (Routine) Diffusion Estimates

- Comparison of atmospheric dispersion site parameters and site characteristics
- COL FSAR Table 2.3.5-202 verified distance and direction of receptors of interest

Section 2.3: Meteorology - Conclusions

- All regulatory requirements for Section 2.3 have been satisfied
- No open items
- No confirmatory items

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Staff Presentation to ACRS Subcommittee

Turkey Point
Units 6 and 7 COL Application

ASE Chapter 2, Site Characteristics
Section 2.4 – Hydrologic Engineering

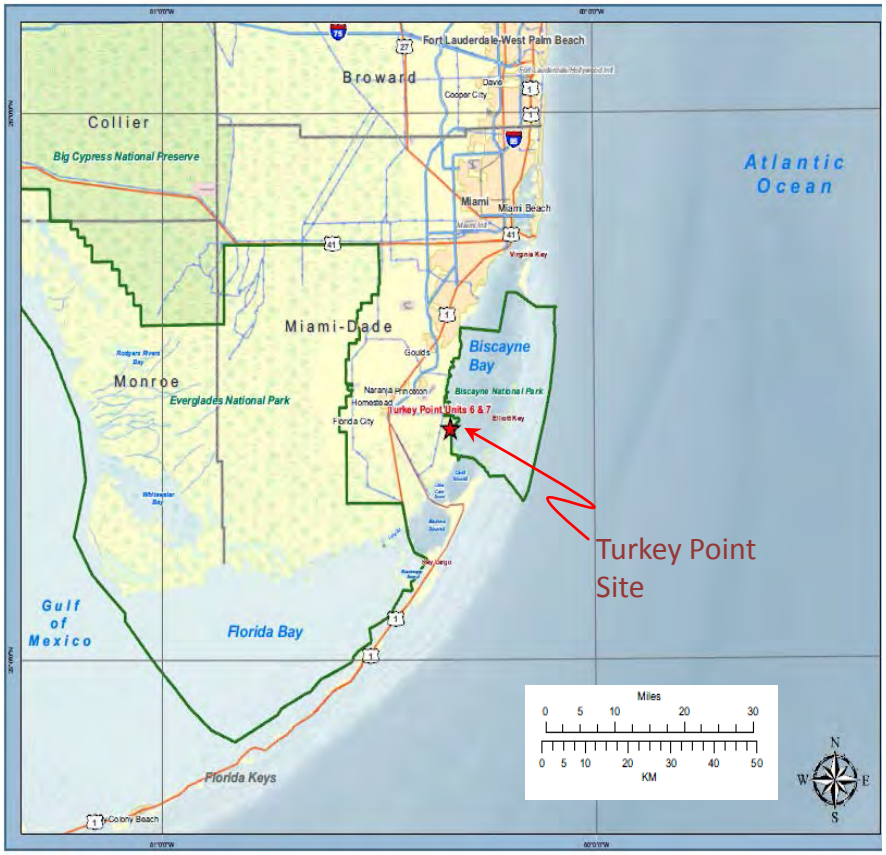
August 18, 2016

ASE Section 2.4 - Technical Review Team

- Joseph Giacinto, Hydrology and Meteorology Branch (RHM)
- Ellen Smith, Oak Ridge National Laboratory
- Patrick Lynette, University of Southern California
- Melanie Mayes, Oak Ridge National Laboratory

Hydrologic Engineering Background

- Hydrologic engineering staff conducted a visit at Turkey Point March 22-25, 2010
  - Topics included site setting, hydrologic site characteristics and associated document reviews
- Staff coordinated review with state and federal agencies
  - FDEP, USGS, USACE, and NOAA
- Performed independent review and confirmatory analyses as explained in following slides

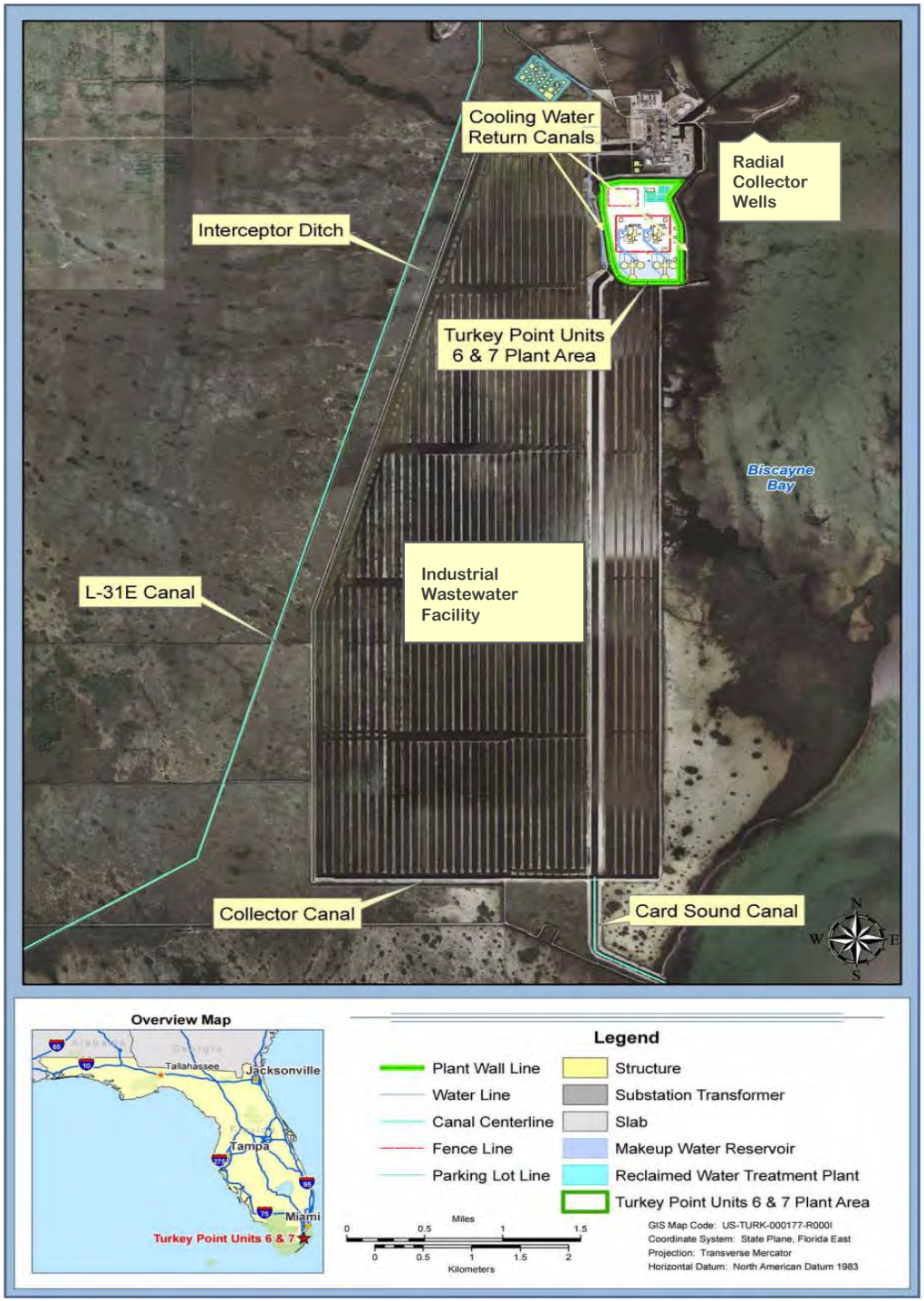


Section 2.4 Review Topics

- Because of Turkey Point's location on the edge of the Atlantic Ocean in south Florida, there are no potential issues related to topics such as ice effects and river flooding
- Topics receiving particular attention in staff technical review were:
  - Local intense precipitation
  - Hurricane storm surge
  - Tsunami
  - Groundwater
  - Accidental radionuclide tank release

Site Map and Features

Plant Design Grade: 26.0 ft

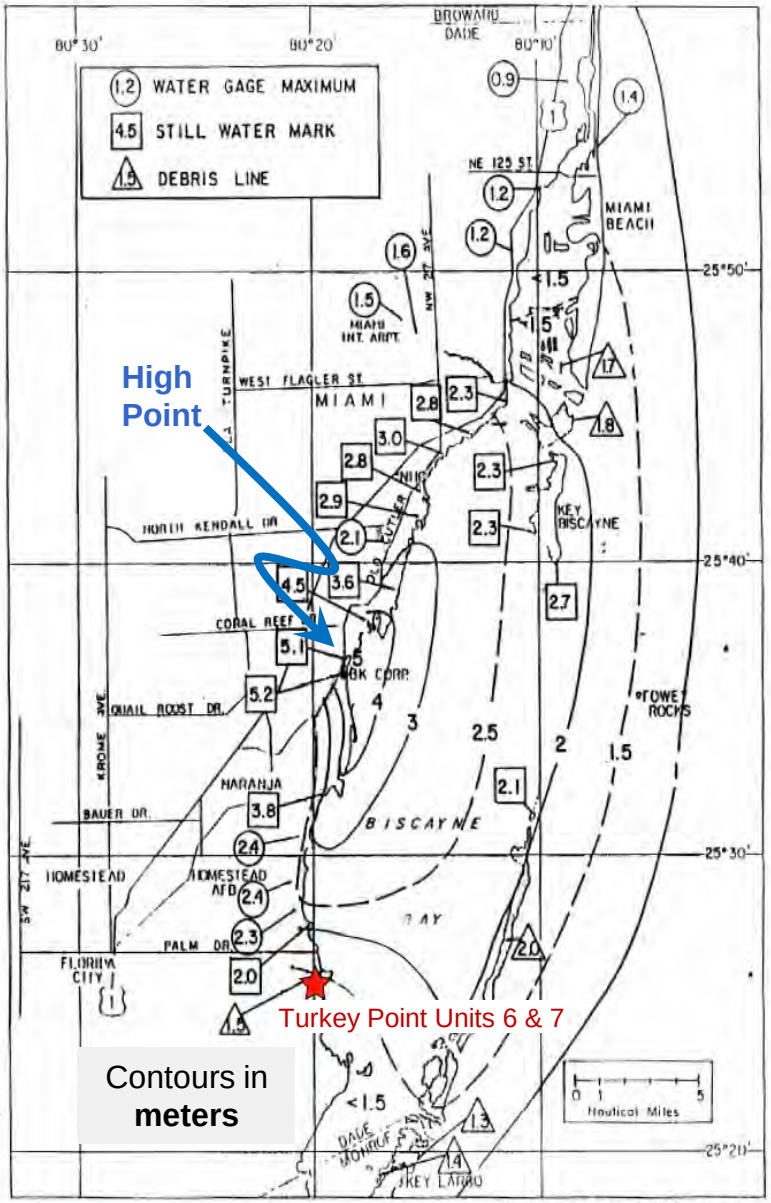


Local Intense Precipitation

- Probable maximum precipitation event 19.4 inches in 1 hour with peak rainfall of 6.2 inches in 5 minutes
- Site drainage via sloped surfaces and drainage swales
- Maximum flood elevations (24.5 ft) remain below design grade (26.0 ft)

Historical Storm Surge

- Turkey Point site faces the Atlantic Ocean, near the site where Hurricane Andrew made landfall in 1992
  - Category 5 hurricane (157 mph winds or higher/catastrophic damage)
  - Resulted in highest Florida storm surge on record
  - Landfall just northeast of Homestead
  - Surge of 3 to 4 ft at Turkey Point and 15.4 ft at 10 mi north of the Turkey Point Site



Observed high water elevations around Biscayne Bay during Hurricane Andrew.

Note: location of Turkey Point site is aproximate.

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Storm Surge

- Applicant used SLOSH model to analyze storm surge from a probable maximum hurricane (PMH) determined using NWS 23 guidance
- Applicant assessed model sensitivity to various storm parameters, including storms more severe than provided by NWS 23
- Modeling assumes that antecedent water level includes 10 percent exceedance high spring tide, sea level anomaly, and a 1 ft allowance for sea level rise for total of 3.6 ft
- SLOSH-predicted maximum still water storm surge elevation is 21.1 ft, including a 20% allowance for model uncertainty
- Including wind wave runup, water surface elevation is 24.8 ft – below plant design grade of 26.0 ft

Storm Surge
Comparison of SLOSH with ADCIRC

- Staff compared applicant's SLOSH predictions with predictions from a modeling study by the Army Corps of Engineers for the NRC that used the ADCIRC code
- Comparison found good agreement with ADCIRC results for storm with 10^{-7} recurrence
- Staff accepts the applicant's conclusion that the PMH event does not affect the safety-related structures, systems and components

Tsunami

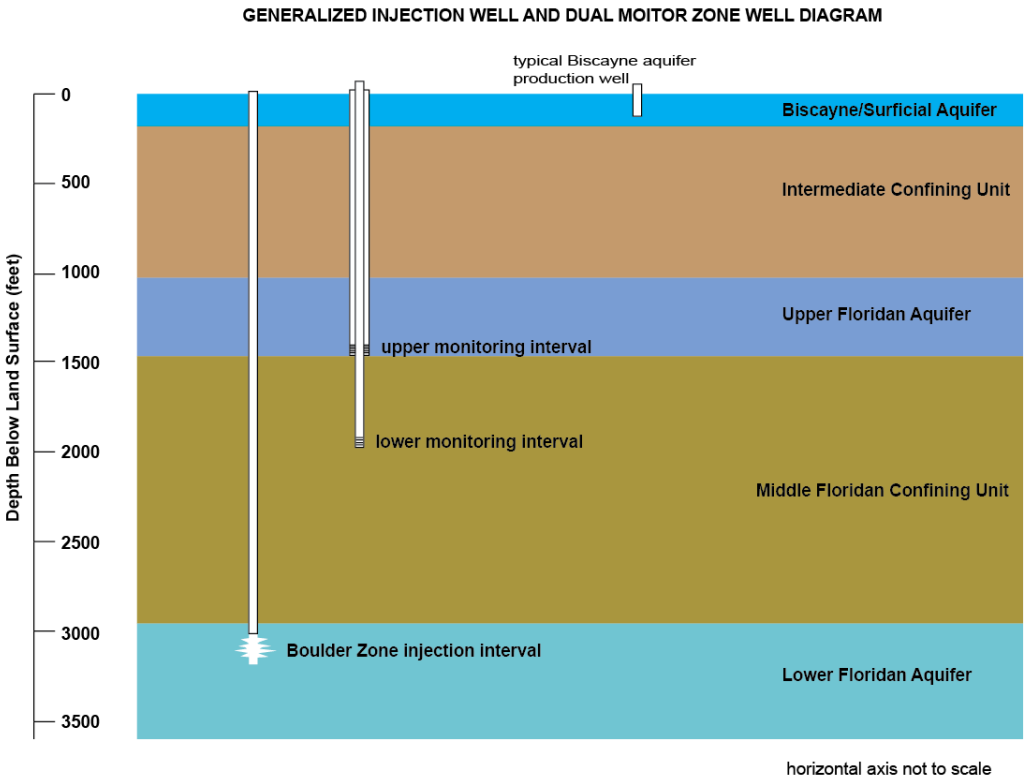
- Staff considered historical record, geological evidence and physical data
- Staff reviewed likely sources: submarine landslides, volcanogenic sources, slope failures, earthquakes
- Staff's independent modeling assessment resulted in surface water elevation of 10.5 ft with an included antecedent water level (3.6 ft) that incorporated 10% exceedance high tide and long-term sea level rise for an overall total of 14.1 ft
  - Good agreement with applicant's value (14.0 ft)
- Tsunami water level is bounded by the probable maximum storm surge

Groundwater
Flow in the Surficial Biscayne Aquifer

- Flow generally from west to east in the vicinity of the site
- Local groundwater elevations are controlled by Biscayne Bay, the Industrial Wastewater Facility, Interceptor Ditch, and South Florida Water Management District canals
- Groundwater discharge may occur to the Industrial Wastewater Facility or to Biscayne Bay
- Both discharge points considered in radionuclide transport analysis
- Maximum site groundwater level of 3.0 ft

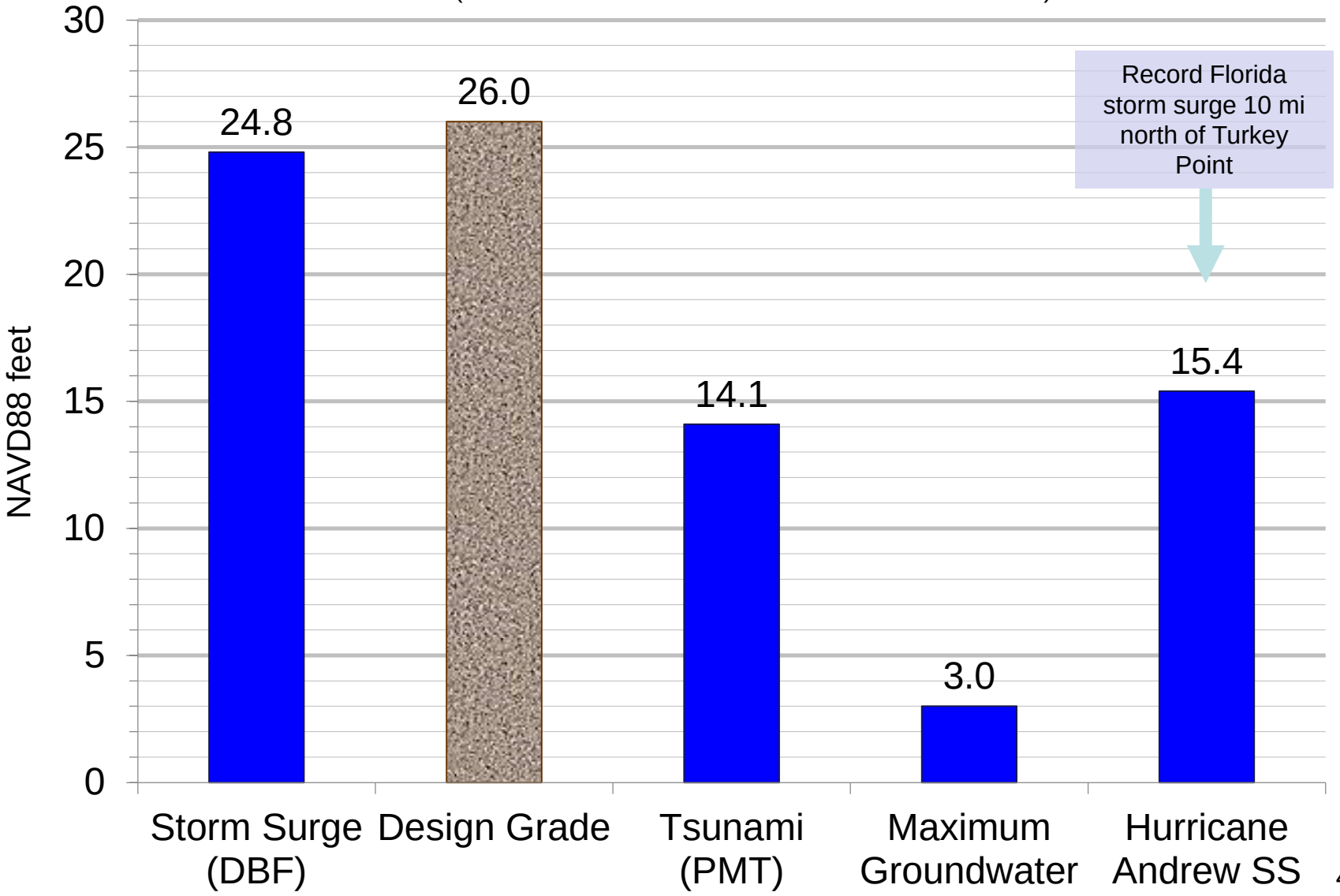
Groundwater
Deep Well Injection of Blowdown and Effluent

- Injection into the Boulder Zone of the Lower Floridan aquifer
  - A cavernous, high permeability, saline zone > 3,030 ft below ground surface at the site.
  - ~ 1,500 ft beneath brackish Upper Floridan Aquifer-separated by less permeable/more confining strata.
- Turkey Point proposes 12 Class I UIC wells and 6 dual-zone monitoring wells
- Conservative evaluation of the injection impacts discussed in ASE Section 11.2 (Liquid Waste Management Systems)



Summary - Water Levels and Turkey Point Units 6 & 7 Design Grade

(Maximum Local PMP flood due to sheet flow: 24.5 ft)



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Turkey Point
Units 6 and 7 COL Application

ASE Chapter 11, Radioactive Waste Management
Section 11.2 – Liquid Waste Management Systems

Zachary Gran

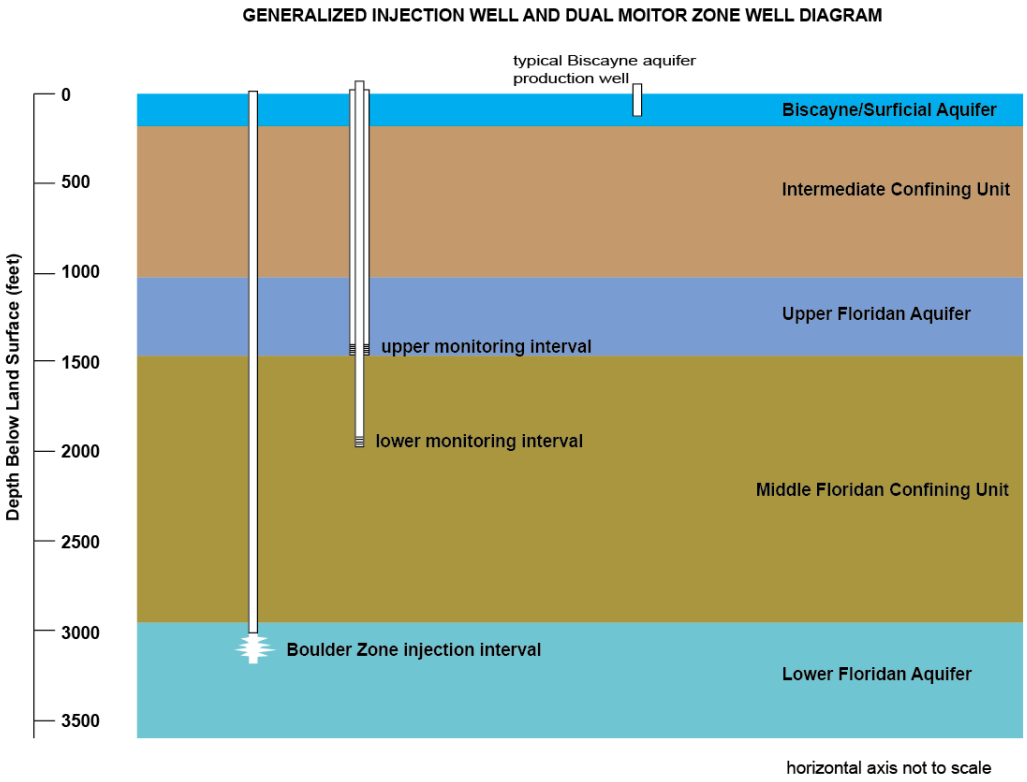
August 18, 2016

Background – Deep Well Injection

- Turkey Point Units 6 & 7 use Deep Well Injection to dispose of liquid waste
- Staff's offsite dose analysis conservatively considered an unlikely full breach of the Middle Confining Unit without considering dilution or decay
- Staff relies on the existing regulatory framework from Florida Department of Environmental Protection (FDEP) in the regulation and construction of Deep Well Injection Systems
- Applicant provided information to comply with 10 CFR 20.2002 alternate disposal requirements.
- 10 CFR Part 20 Appendix B requirements are met at point of discharge

Background – Deep Well Injection

- Injection into the Boulder Zone of the Lower Floridan aquifer
  - A cavernous, high permeability, saline zone 3,030 ft below ground surface at site
  - ~ 1,500 ft beneath brackish Upper Floridan Aquifer- separated by less permeable/more confining strata
- Around 180 FDEP Class I Underground Injection Control (UIC) wells permitted in Florida.
- Monitoring and testing methods required in 3 stage permit process (exploratory, construction, operation)
- Turkey Point proposes 12 Class I UIC wells and 6 dual-zone monitoring wells
- Injection rates by source:
  - Primary- Reclaimed water- 18 MGD
  - Backup- Radial Collector Wells- 83 MGD



Staff Analysis

- Demonstrating Compliance with 10 CFR 20.2002
  - (a) a description of the waste, including the chemical and physical properties important to risk evaluation and the proposed manner and conditions of disposal;
  - (b) an analysis of the environment in which wastes will be disposed;
  - (c) the nature and location of other potentially affected licensed and unlicensed facilities; and
  - (d) analyses and procedures to ensure that doses are maintained ALARA and within the dose limits of 10 CFR Part 20
- The staff typically approves 10 CFR 20.2002 requests that will result in a dose to a member of the public (including all exposure groups) that is no more than “a few millirem/year”
  - This information is in SECY-07-0060, Attachment 1, and NUREG 1757, Volume 1, Revision 2, “Decommissioning Process for Materials Licensees,” Section 15.12
  - Staff used the criteria in 10 CFR Part 50, Appendix I, for suitable criteria for evaluating dose

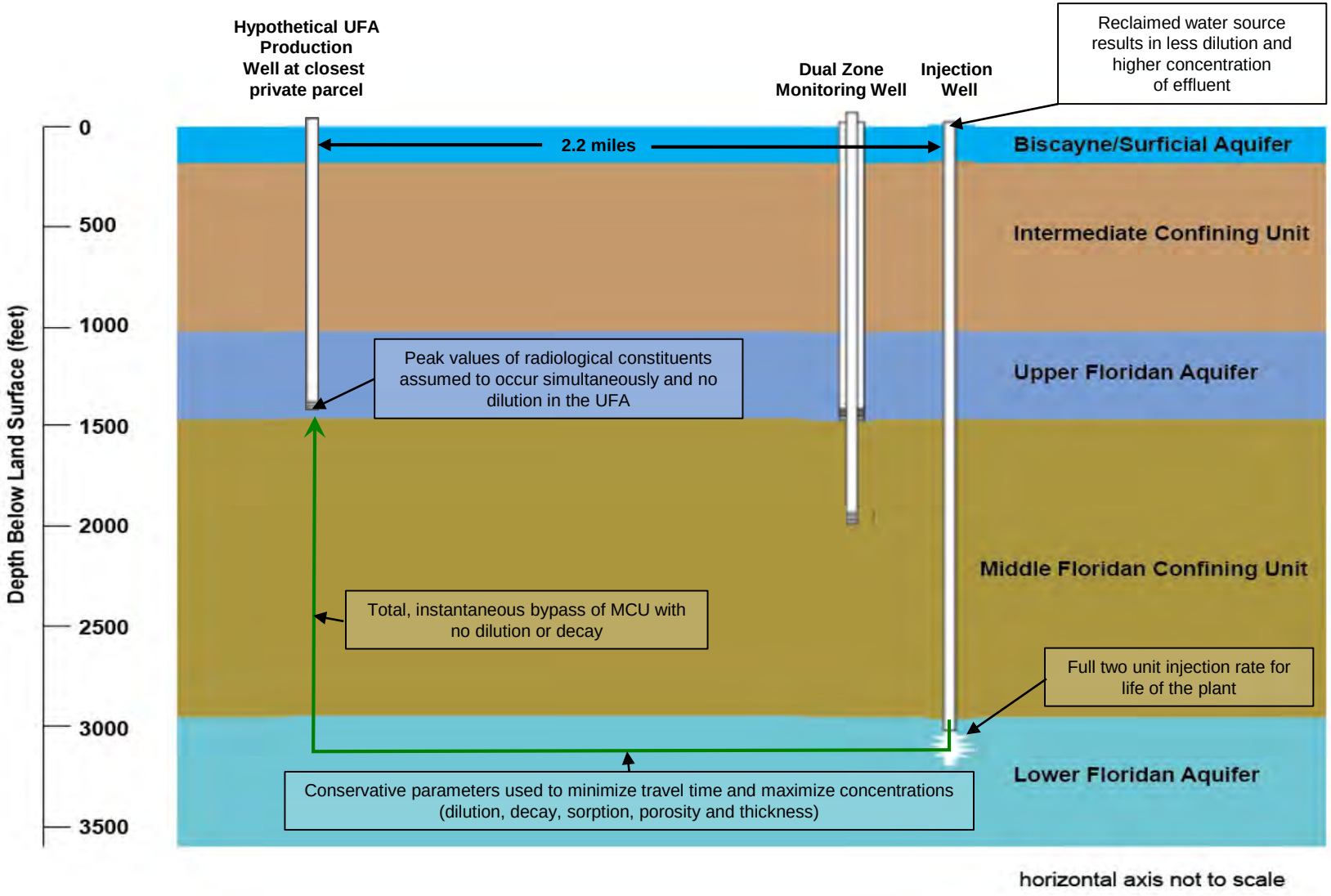
Staff Analysis

- Staff performed an independent dose analysis using the concentrations described by the applicant
- The concentrations of the radionuclides described by the applicant with highest contribution to dose were determined to be conservative through independent verification performed by the staff
  - Considered H-3, Cs-134, Cs-137, and Sr-90
  - Used the DCFs and consumption rates described in RG 1.109
  - Assumed full breach of the Middle Confining Unit
  - Identified nearest receptors at 2.2 miles NW and 7.7 miles SE of the site
  - The staff's analysis considered irrigated vegetables, irrigated milk, irrigated meat and drinking water as potential pathways
    - Staff's analysis for compliance only used the irrigated vegetables pathway since no other pathway was probable based on land use practices

Staff Analysis

- The staff considered the following scenarios:
  - Well failure and release of effluent into the Upper Floridan Aquifer
  - Upwelling of injectate from Boulder Zone through a competent Middle Confining Unit
  - Inadvertent exposure of injectate onsite
  - A full breach of the Middle Confining Unit and a hypothetical well at point of Middle Confining Unit breach
    - Determined to be the bounding scenario
    - Assume that the concentration present at 2.2 miles in the Boulder Zone is used at the receptor
    - Highest concentrations of each radionuclide is being used
    - No decay or dilution is assumed when being transported from the Boulder Zone to the receptor location

Bounding Injection Transport Scenario Evaluated by Staff



Staff's Conclusion

- Based on the conservative assumptions stated by staff the dose was determined to be below the dose limits.
- 10 CFR Part 20 Appendix B
  - Batch release of liquid waste
  - Compliance is met by specifying and maintaining flow rates at the blowdown sump discharge corresponding to at least the minimum dilution factor prior to discharge
- 10 CFR Part 50 Appendix I
  - Staff confirmed the results reported by the applicant through independent calculations and confirmed doses are below the design objectives.

Staff's Conclusion

- Compliance with 10 CFR 20.2002
  - The waste disposed and manner of disposal has been described
    - ECLs of 10 CFR Part 20, Appendix B;
    - Applicant follows the design guidance of RG 1.143
    - Description of injectate piping has been provided
  - An analysis and evaluation on the nature of the disposal to the environment has been discussed in FSAR sections 2.4.13, 9.2.12, 11.2 and in ER section 2.3.2.2
  - The nature and locations of potentially licensed and unlicensed facilities are fully described. The staff has considered the locations of the MEI in the staff dose analysis
  - Doses are maintained by demonstrating compliance against the limits of 10 CFR Part 50, Appendix I, and the maximum dose criteria of "a few millirem"